

# Aviation Week & Space Technology

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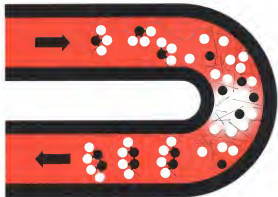
A McGraw-Hill Publication

July 8, 1963

**Navy Planning  
Integrated ASW  
Avionics System**

**Dassault Mirage 4  
Strategic Bomber**





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## AEROSPACE CALENDAR

(Continued from page 5)

- American Institute of Aeronautics and Astronautics, Executive B*  
Aug. 19-22—Advances in Conformation  
*American Institute of Aeronautics and Astronautics, Yale University, New Haven*  
Aug. 19-21-1965 Cygnus Engineering Conference, Santa Clara, California  
*University of Colorado, NBS Chicago Engineering Laboratory*  
Aug. 20-21-1965 Western Electronic Show and Convention (WESCON), Cow Palace, San Francisco, Calif.  
Aug. 26-28—Symposium for Aerospace Flight Conference, American Institute of Aeronautics and Astronautics, Double Hilton Hotel, Columbus, Ohio  
Aug. 28-29—Conference on Physics of Entry and Planetary Atmospheres, American Institute of Aeronautics and Astronautics, Massachusetts Institute of Technology, Cambridge, Mass.  
Sept. 8-12—International Symposium on High Temperature Technology, Aachen, Cold Spring Harbor Research Institute, U.S.A.  
Sept. 13-14—Annual Meeting, Air Industries Association of Canada, Monte Carleton, Montreal, Quebec  
Sept. 21-22—General National Convention in Military Electronics, Institute of Electrical and Electronics Engineers, Sheraton Hotel, Washington, D.C.  
Sept. 24-25—15th Annual Electronic Audio-Visual Conference & Exhibit, Instrument Society of America, McDonald, Ft. Chicago, Ill.  
Sept. 10-12—National Symposium on Space Exploration, Russia and Recovery, Edwards AFB, Cold Spring Harbor, Astronautical Society, Air Force Flight Test Center  
Sept. 18-22—New York University's Third Annual Air Transport Conference, Washington Space Center, New York, N.Y.  
Sept. 18-19-70 Annual National Convention & Aerospace Progress, Air Force Association, Sheraton Park and Sheraton Hotel, Washington, D.C.  
Sept. 18-19—International American Research and Development Symposium, Miami City, N.J. Spencer Federal Aviation Agency  
Sept. 19-19-1965 Aircraft Operations and Maintenance Symposium, Mahwah, N.J.  
Sept. 20-22—North Atlantic Treaty Organization Trade & Transit Fair, San Jose, San Carlos, Houston, Tex.  
Sept. 23-27—National Automotive and Space Engineering and Manufacturing, Moving and Display Society of Automobile Engineers, Ambassador Hotel, Los Angeles  
Sept. 23-27—International Telecommunications Conference, Royal Hotel, London, England, Space Institution of Electrical Engineers (London), American Institute of Aeronautics and Astronautics, Institute of Electrical and Electronics Engineers, Instrument Society of America  
Sept. 25-26—Second Annual Symposium on the Physics of Fusion in Electronics, Chicago, Ill. Spencer Bureau of Development Center, American Research Foundation  
Sept. 26-28—1-1965 Congress, International Astronautical Federation, Paris  
(Continued on page 9)

## PROBLEMATICAL RECREATIONS 178



The area and volume of a certain sphere are both 4-digit numbers. What is the radius of the sphere?  
—Continued

Inertial Systems Engineers interested in guaranteeing hardware should investigate positions now available in inertial navigation and astro-inertial systems in our Guidance and Control Systems Division. It helps to have experience in gyroscopes, accelerometers, servo-mechanisms and computers. Interested applicants are directed to send a résumé to Mr. T. T. Lutz. You will receive immediate attention.

**ANSWER TO LAST WEEK'S PROBLEM:** If it is odd,  $14^3$  inch (in 4. R. does  $11 \times 14^3$ , therefore  $11 \times 14^3 + 1$  ends in 5 and hence is divisible by 5. If it is even, say equal to  $2n$ ,  $11 \times 14^3 + 3n$  is equal to  $11 \times 196 + 3n$ . Since  $196 \equiv 3 \pmod{3}$ ,  $11 \times 196 + 3n \equiv 11 \pmod{3}$  will always leave a remainder of 1 when divided by 3. Therefore  $11 \times 196^3 + 1 \equiv 11 \pmod{3}$  or  $11 \times 196^3 + 1 \equiv 2 \pmod{3}$ . Hence when it is even,  $11 \times 14^3 + 1$  is always divisible by 3. Therefore  $11 \times 14^3 + 1$  is never a prime, being a multiple of 3 or 3 according to it is odd or even.

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architects/engineers and constructors  
 (asked to contribute)  
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## AEROSPACE CALENDAR

(Continued from page 71)

- [illegible]

## PUTTING THE WORLD ON A BLACKBOARD

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# Aviation Week & Space Technology

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July 8, 1968

VOLUME 79  
NUMBER 2

EDITOR: Robert W. Smith, Jr.

ASSOCIATE EDITOR: Robert W. Smith, Jr.

MANAGING EDITOR: William G. Smith

DEPUTY MANAGING EDITOR: William G. Smith

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## EDITORIAL

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COVER: Boeing's Boeing 4 aerospace strategic bomber is shown taking off from its runway during the recent Paris Air Show. The aircraft was shown in a planned to further French's strategic nuclear weapon delivery capabilities. Grounded remains will be reviewed by two Boeing Air Force units with advantages. For additional photos see pp. 44-45.

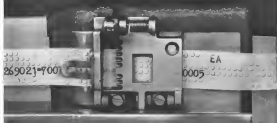
## EDITORIAL

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## New Transport Equipment

Less than two years after the prospects of decreasing some of the advanced representatives of the transport industry, predicted that the airlines had overbought themselves into permanent lean with jet equipment, these same carriers are shopping around for more jets and there is an emotional stirring of new technical developments for the transport market. The airlines are now well aware that they are shopping in a hot market and are in no haste to make their commitments in the next major round of aircraft buying. They are also examining technical and economic dimensions based on their rapidly expanding experience with jet equipment by carefully reviewing the current and future crop of transports on the market.

Even though its operational debut is still a long way off, the supersonic transport is already on the airlines' shopping list and the sales competition in this area has already begun. It is rather fruitless for airline managers or pilots to argue over whether there should be a supersonic transport, for its development and use are inevitable. What is not quite so crystal clear at the moment is what kind of supersonic transport will dominate the market and what nations will reap the major harvest from its manufacture and sales.

We noted last fall at the time of Farnborough that the Anglo-French Mach 2.2 Concorde supersonic transport program was a far more sound and serious project than was generally credited at that time. Events have borne that out. Firm support from the British and French governments and a sufficiently rapid technical pace by the four major engine and airframe firms involved have stored an American airline into granting a competitive spot on the Concorde production line, and spurred the American government into a flurry of activity over its own dwindling supersonic transport development program.

It is naive to note the divergent approaches being taken by the Anglo-French consortium and the U. S. toward financing and managing the costly development program necessary to produce a supersonic transport. The Anglo-French effort is being managed entirely by the best technical brains of its industrial partners, with the government confining itself to financial support. The government-owned airlines, which have reacted up to now, either pressing French transport development with their technical input, have been carefully united to obtain during the Concorde's development period. This it appears that the chances are brighter than ever before that the Anglo-French Concorde team will be free to produce its best technical job, with a maximum of interference from either civil service types or officials of state-owned airlines.

In contrast, it appears that the U. S. is heading in the opposite direction, embracing every possible government agency in the program, and thus complicating this bureaucratic maze by a welter of specially appointed committees and study groups. The old aircraft industry where "to succeed is a rare horse designed by a committee" was never more applicable than to what is now

transporting in the U. S. supersonic transport program.

If the time and money now being consumed by so-called research and study of the problem were devoted to getting on with the job, both the eventual airline users and the manufacturers of the supersonic transport might view the future with less concern. The U. S. has been firing the X-15 research aircraft through the supersonic speed range on Mach 5 for several years. This country has accumulated a good deal of useful experience from the North American X-15 program and will continue to do so. And the U. S. has had a wide variety of sound research facilities working on the Mach 3-plus speed range for a number of years.

The technical people who will ultimately have to build the U. S. supersonic transport feel they can start the task immediately, with excellent prospects for a technically sound product in the early 1970s. There are enough tried design approaches among the first major manufacturers who are interested in tackling the supersonic transport job to ensure that all the possibilities could be considered if a design competition were started right now.

The Air Force, which has had more experience than any organization in the world in the procurement of supersonic aircraft, and which has certainly profited by its X-15 experience, is unquestionably capable of running such a design competition and picking a sound winner. What then is all the hodgepodge about in the Federal Aviation Agency, the White House and the Congress? If President Kennedy is really serious about developing a U. S. supersonic transport that will dominate the commercial airways of the 1970-80 period, the way the jet transports from San Diego, Santa Monica and Seattle dominate air commerce in this initial decade of the jet age, he can save time and money by authorizing a competitive design competition among the interested manufacturers with some federal report during this phase. They will at least give the program more direction and a goal, in contrast to the endless waddling and foot-dragging that now characterizes it.

While the Europeans have apparently profited by their earlier mistakes in entangling technical development with government bureaucracy, the U. S. is apparently abandoning its well-proven competitive system and following the thoroughly disapproved British Ministry of Supply pattern. We think it would be a grave mistake for the U. S. to try to slide into the Anglo-French Concorde program at this late date (see p. 25). We think it would be a equally grave error to continue along the present path of the U. S. program, shortening "competitive free enterprise" in public and entangling the technical development in the tangle of an unbelievably complicated political maze. The U. S. should embark on a serious supersonic transport program because it will be an economic asset in the long run. But it should do so in such a manner that whatever government support is required does not hobble technology, is a mass of bureaucratic red tape and committee reorganized compromises.

—Robert Hottel

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cally minded, MEC has shipped over 4,000 metal ceramic traveling wave tubes in just 3 years. Our record and repeat rate here mean we know we're just about nailed the replacement market for ourselves.

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## WHO'S WHERE

### In the Front Office

**Earl Dallen Ingram**, vice chairman of General Dynamics Corp., has resigned as an officer and director but will continue to serve the company as a consultant.

**Craig A. Collins**, vice president and general manager of The American Cancer Society, is replacing **Elizabeth Campbell**, retired (AVR July 1, p. 3).

**Anthony Nardelli**, public relations director, International Air Transport Association, has been named director, Bureau of Air American Airlines Publications.

**Leslie C. Fennell**, president and director, Lockheed Corp., Norwalk, Conn., and **William C. Dwyer**, vice president, chairman and director, The Dr. George M. Nissen Foundation, vice president, engineering and technical director, **Maxwell J. Koberstein**, vice president, manufacturing.

**Dr. Walter A. Price**, president, The West Scientific Clinic Co., Winston, Calif., a subsidiary of Hecox 500, Calif.

**Wes Thomas C. Mangum**, Jr. (USAF), vice president, Technion, Inc., with headquarters in Washington, D.C.

**Dr. Thomas J. Chisholm, Jr.**, a corporate vice president, Itek Industries, with headquarters in Washington, D.C.

**Dr. G. Russell Tatum**, vice president, Vetus Corp. of Los Angeles, responsible for all technological activities of the company, he continues to head of Vetus Laboratories, Dr. Miller Spring, Md.

**Peter T. Albert**, vice president, flight into the Phoenician Tower Inc. moved to John F. Higgins, resigned.

**Leslie C. Spill**, a vice president, Fluor-Oxyd Systems, Inc., Pasadena, Calif., he continues as corporate manager of operations.

**Walter E. Stevens**, vice president, operations, Le Roy, Tenn. International Corp., New York, N.Y.

**Harvey J. Woods**, vice president, program and plant, Rockwell International, The York Corp., Washington, D.C.

**R. W. Phillips**, vice president, Strategic, Inc., Ft. Worth, Texas.

**Joseph F. Bartholomew**, vice president, space, Cambridge, Mass., and vice president, department manager of the rock Island Cambridge, Inc. of the company.

**Madison Brinkley**, vice president, marketing, Telecommunications Corp., Los Angeles, Calif.

### Honors and Elections

**Col. Edwin E. Aldrin** has been elected a fellow of The American Society of Mechanical Engineers.

**Dr. John C. Lane**, an Australian-born flight surgeon, has received the Flight Safety Foundation's Award for Distinguished Service, the "Gold Medal" for his efforts in the pursuit of new aviation medicine.

In the Commonwealth of Australia has also been an author or co-author of eight separate human engineering reports relating to the prevention of landing accidents. The Foundation distinguished award is presented to the author of the report, which is sponsored by Australia's Vets and Space Technology (Continued on page 9)

## INDUSTRY OBSERVER

► Airplane control propulsion capacity of the Douglas S-4B stage will limit to about 10 hr. The time the Apollo spacecraft can remain on orbit after leaving the stage is about 10 hr. The Apollo 11 is a landing mission. Lunar Lander Module will make at least one complete orbit of the moon before descending to the surface, but the landing must occur by the end of the third orbit or be aborted.

► North American Aviation's Space and Information Systems Div. has invited groups from USAF's Space Systems Div. to participate in a "Blue Apollo" for Air Force space mission. S-4B was not a success, partly because the Apollo spacecraft would be available only after National Aeronautics and Space Administration experiments, and the USAF funds research could be more sophisticated spacecraft which are in keeping with the state-of-the-art program for 1970.

► Industry proposals for the high-tonnage capacity of data processing and display equipment for the airborne post office, command and control system (MACS) will be required soon by USAF's Advanced Research Office. Equipment will be installed in a Boeing KC-119 to give Strategic Air Command a completely automated surveillance control post. PVCS has been replaced. SAC's present KC-119 being converted post, which largely uses manual command and control techniques.

► National Spacecraft Center has two fiscal 1969 space station studies will be awarded October 1 to Lockheed Missiles & Space Co. and Douglas Aircraft Co. Lockheed will study the large, rotating station under a \$500,000 contract and Douglas will study a large, wing station under a \$400,000 contract. Langley Research Center will award a preliminary space station laboratory design contract to Boeing or Douglas this fall.


► NASA's Langley Research Center is expected to make requests for proposals for the first of a series of lunar orbiters. Program has been delayed by lack of funds, but NASA took the lunar photographs which is essential to pick moon landing sites for Apollo missions and probably will emphasize the program for at least one spacecraft before landing sites are selected. Operational target for the orbiter is Jan. 1969 or early 1969. Photographs will be taken at successive lower orbits, down to about 25 mi. from the lunar surface.

► Use of helium in an additive to increase prebaked solid propellants has produced specific impulses of 260-285 sec., compared with 245-250 sec. produced by ammonium, according to Advanced Research Projects Agency. ARPA is also investigating the possibility of using specific impulses of 275-275 sec. with aluminum hydride and 290-275 sec. with benzene hydride. A specific impulse of 280 sec. would permit the payload of a missile or rocket to the Moon to be doubled, or the size and weight of such a vehicle to be reduced 50%.

► Abandonment of 10 mi. has been made for scientific experiments aboard the Apollo Lunar Ejecta Module. Although the experiments have not yet been selected by NASA, this is expected to consist mainly of lunar geology measurement devices.

► Recent Navy tour of laboratories throughout the country in search of fresh approaches to high-energy laser led to submission of more than 200 unselected proposals to Office of Naval Research. Navy was spurred by the corrupting progress of the Advanced Research Projects Agency's device research laser induction weapons program (AVR June 17, p. 21). While CONA, advanced Navy is awarding a large series of experimental and research contracts on high-energy devices such as reactor pump laser, exploding thin Quenches, liquid lasers and improved vacuum flash lasers (AVR July 1, p. 90) with additional ARPA funds.

► Contract for 11 S-2 targets, including more flyable units, has been awarded by NASA, at about \$210 million by North American Aviation's Space and Information Systems Div. The S-2, second stage of the Saturn 3, will incorporate five Blackstone J-2 engines burning liquid hydrogen and oxygen.



## Who put the red telephone in the sky?

The Strategic Air Command's red telephone is as much a part of our deterrent strength as the nuclear fire power it controls. Through SAC's Airborne Command Post, Electronic Communications, Inc., provides an airborne communications system that can survive a nuclear attack. Flying around the clock, these command post planes enable SAC to order and deliver a retaliatory strike even though its main and alternate command posts are destroyed. □ As prime communications contractor for the Airborne Command Post, ECI, in cooperation with the United States Air Force, introduced a number of firsts in command and control systems, including: the first airborne UHF multiplex system, first airborne switchboard facility and first airborne sea-to-land, land-to-land UHF transmitter. □ To meet your communications system requirements, call on the company that has proved its capability. . . . ask



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## Man-In-Space Upkeep

## Washington Roundup

National Aeronautics and Space Administration plans to spend four times as much on manned space flight between now and the end of fiscal 1968 as it did in the five years from the beginning of the space program in fiscal 1959 through fiscal 1963—\$14.1 billion compared with \$3.5 billion.

Total cost of the manned lunar landing effort becomes \$19.7 billion when the agency's own associated costs are counted. The \$19.3-billion estimate is the "hard-core" funding program for Mercury, Gemini and Apollo and does not allow for spending for manned flight efforts beyond the moon.

At least one such advanced program is expected to be approved before 1970. Leading candidates are a lunar logistics system estimated to cost \$500 million, a space station costing between \$1 billion and \$4 billion, a Mars mission which could cost as much as \$40 billion, and a moon base, which has no firm cost estimate yet.

Manned space flight funding thus far now is estimated at \$3.4 billion under the hard-core program. This fiscal 1964 figure approximates the \$3.5 billion spent on manned space flight in the five-year period from fiscal 1959 through fiscal 1963. NASA's estimate for fiscal 1965 through 1969 is \$10.9 billion, indicating that fiscal 1964 may be the most of the spending wave.

## NASA's Internal Ills

NASA's internal squabbling there has been a weakening of the national leadership since control on manned space flight by its departing director, Dr. Robert H. Goddard (AWF June 27, p. 37). Goddard's work on a 12 hr. day before his troubles with Administrator James E. Webb caused him to resign, effective this fall. Now Hales' day is near, his name to live. Webb last week tried to restore leadership harmony by conferring at length with Manned Spacecraft Center officials at Houston, Tex., about their program.

New director of the Advanced Research Projects Agency will be Dr. Robert L. Spang, physics professor and director of the materials science center at Cornell. He reports in September. Dr. Jack P. Ragan, ARPA's former director, will serve as a consultant to the Communications Satellite Corp. was announced that he will join the faculty of Massachusetts Institute of Technology in an electrical engineering position in the fall.

## Tighten AEC Control

Congress is tightening its grip on the Atomic Energy Commission by requiring the agency to submit its research budget to the Joint Congressional Atomic Energy Committee as well as to the House and Senate appropriations committees. Currently, the joint committee only has approval authority over the AEC construction program, which accounts for about 80% of the total budget.

Sen. John O. Pastore, committee chairman, contends the AEC research budget is so complex that the extra congressional supervision is needed. Legislation granting the authority already has passed the Senate and is certain to pass the House. Sen. Pastore's action exemplifies a more skeptical approach toward AEC activities. His stance is looking into the politically touchy question of whether the agency is over-producing nuclear weapons.

A major reason why Rep. Owen Roark called hearings on the aerospace transport was to help establish his House Commerce Committee jurisdiction over that segment of the program. House Science and Astronautics Committee approved aerospace transport research funds this year and may compete for jurisdiction.

## VAX Outlook Gloomy

Role that the VAX two-engine attack fighter should fill will not be decided until Defense Dept. action on the aircraft needed for close troop support as countermeasures. VAX will be designed to fill the gap between the GCHN assault and the F-111 (TFX) GCHN in getting priority consideration, with September looking as the deadline for establishing a specific budget request.

Dr. Harold Brown, director of defense research and engineering, is evaluating various proposals at present. He recently told Congress that VAX technology is not the problem. "The question is what you really want," he said. He estimates development and production cost of the VAX would be about half of that for the F-111, or about \$3.5 billion, for 1,700 aircraft. He estimates development alone for 24 aircraft would cost about \$500 million.

In the face of pessimistic USAF reports, North American is still making preparations for the first flight of its B-70 some time this summer, even to the point of getting Al White of the firm as pilot and USAF Lt. Col. Fitzhugh Fulton as copilot. First flight would be subsonic and probably no more than 90 min. long. Rep. Gerald R. Ford, making Republicans on the House Defense Appropriations Subcommittee, brushed aside all official pessimism recently and told the House "My own forecast is that the first flight will take place in October."

General Accounting Office, congressional watchdog feared by the services, put this diplomatic title on a recent blunt report: "Improvised Dispatch of Cruise Ships and Unmanned Freighter of Outboard Motor Under a Modernization Program of the Department of the Army."

—Washington Staff







## CH-3C Picked for SOR 190 Role

Shoeb CH-3C nonloading version of the 54th twin-engine helicopter last week was selected to fulfill the Air Force Specific Operational Requirement 190 in a second competition for a USAF language support helicopter. Boeing Vertol had won the initial competition last summer, but no contract was signed to produce the vehicles. The CH-3C is an interim aircraft and opened a second competition between Sikorsky and Vertol this spring for the final award. Sikorsky asked for the first two leading versions last month and flew it a month ahead of schedule. The CH-3C has a range of 110 mi with a 2,400-lb load.

the loss of substantive Air Force and Navy negotiations, "it is concluded that Air Force and Navy concepts for mission accomplishment, their timing possibilities, weapons system planning and resultant weapons system characteristics differ to such a degree that development of a single TFX result to fulfill stated requirements of both services is not now technically feasible and would place severe operational penalties upon the Air Force and the Navy."

He excluded a separate list of three operational penalties including "only 37% overall effectiveness in air-to-air combat" reduction in both the number of aircraft which could be placed in a carrier and the number of carriers for combat, the loss of the cooperative USAF-Navy TFX, "no covered hazards in safety of flight deck operations," "more risk in the aircraft development program, higher procurement and operational cost than was warranted," reduced reliability and increased maintenance of the risk caused by the blocking issue of the TFX.

On Sept. 1, 1951, after screening Navy and Air Force objections to the separate F-11 development, McNamara ordered that it be done, and said that "the Navy version of the basic aircraft to be developed under this program shall be capable of performing the Navy fleet air defense mission... [W]hile not an issue objecting to the Navy F-11 was written before the Douglas Mission project was canceled. "So, in effect, TFX Navy version is being done with greater aircraft capability than the whole business of Eagle Mission," Wichita told the Senate group.

Sen. McClellan asked "You never did agree, did you, that TFX was a waste of time and effort after the secretary of defense ordered it?" Wichita replied that after the industries proposed for the F-11 were submitted, "it appeared quite likely that the major requirements of the Navy would in fact be met by a plane of slightly larger weight, but the mission requirements, the way we structure, and speed requirements would easily be met. This was a surprise to all of us, and this certainly changed my mind with respect to it."

When Sen. McClellan asked Keith how he could acquire the confidence in the Navy recommendations with Keith's support of the S-2 service F-11, the Navy secretary replied "This [F-11] was a conscious and honest statement made at the time quite obviously proven wrong by subsequent events, because we do now have an operational aircraft which does indeed meet the requirements of the Navy as certified by the chief of naval operations."

Subcommittee members stressed that the Navy should be proving heavy penalties in performance because of comparison with the Air Force, including a combat ceiling 4,500 ft less than do aircraft and an aircraft weight 13,000 lb more than that of the Navy's McClellan, Henry M. Jackson (D-Wash.) and Karl E. Mundt, (R-S.D.) intend to make penalties exacted by the compromise aircraft a central point in this challenge in coming weeks the F-11 discussion made by Keith, McNamara, Deputy Defense Secretary Russell L. Galpin and Air Force Secretary Eugene M. Zuckert.

But the real point must wait until the F-11 actually flies. Several top-ranking Air Force and Navy officers fear that technical difficulties and the performance shortcomings of the F-11 may become so evident that McNamara will cancel the program before it reaches the production stage. But there is no strong evidence now that this will happen. McNamara appears more likely to insist on completing the development to demonstrate the soundness of his decision.



## GE YJ93 Test Run Shown

General Electric TPE3, 33,000 lb thrust turbojet developed for use in the North American Avonics Inc. B-70, is shown doing a test run at General Electric's large jet engine test cell. Engine completed its Preliminary Flight Rating Test last week (AW May 7, 1962, p. 35) and currently is designed for a 100-lb (one between aircraft) thrust.

## Senate Unit Collects Evidence To Challenge Nuclear Test Ban

By Katherine Johnson

Washington—Senate Preparations in investigating Subcommittee is completing a comprehensive record of testimony to challenge almost any conceivable nuclear test ban agreement that could emanate from top-level U.S.-British Senate negotiators, scheduled to start July 15 in Moscow.

The subcommittee's closed-door sessions, directed at the need for nuclear testing to maintain the U.S. military posture, started early in May and have produced 1,119 pages of testimony. The witnesses are Sen. Gen. Curtis LeMay, USAF chief of staff, and John W. Anderson, outgoing chief of naval operations, and the top officials of Defense Dept.'s Defense Atomic Support Agency, Central Intelligence Agency, Atomic Energy Commission, and the Arms Control and Disarmament Agency (ACDA).

The subcommittee's hearings will extend a few more weeks and include testimony from Gen. Earle Wheeler, Army's chief of staff, Dr. Harold Brown, director of defense research and engineering, and several atomic scientists.

The attitude of the subcommittee toward a nuclear test ban agreement

was presented by Sen. John Stennis (D-Miss.), the chairman, in his statement to the Senate:

"It is this initial agreement which the very survival of our country might depend on must be proven, not only by sound and reasonable doubt, but to the existence of even reasonable probability of a doubt."

W. Averell Harriman, under secretary of state for political affairs, will represent the U.S. at the Moscow negotiations. He will be joined by African S. Polak, deputy director of the Arms Control and Disarmament Agency.

Thirty-four senators, led by Sen. Thomas C. Donnell (D-Gew.), have sponsored a resolution calling for a ban on atmospheric and underwater testing (AW June 15, p. 35).

It states that "a ban on all tests that contribute to the atmosphere or the ocean can be effectively negotiated and acquired on an equal perspective approach, would completely eliminate the danger of clandestine atmospheric fall out, and would contribute a beginning in curtailing the arms race."

In the past, the USSR has asked to consider a partial ban, claiming that U.S. technology is far ahead and its capability greater for under-

ground testing. Last month Soviet Chairman Khrushchev stated this position, saying Russia would accept a ban on atmosphere and underwater testing, but only as part of a broader disarmament agreement.

Sen. Stennis said: "It is atmosphere testing here come all of our major nuclear weapons developments and our knowledge of the means to employ them most effectively is the delicate of our country. If it should become necessary, for its part I would support an atmospheric nuclear test ban only if I was certain convinced that there is absolutely no relationship between continued testing in the oceans and the ability of our submarines to avoid strike forces to survive a surprise nuclear attack."

Sen. Stennis indicated that atmosphere testing is required to achieve these goals, defense against Soviet international ballistic missiles, a capability to penetrate a Soviet missile defense employing nuclear warheads, assurance of the readiness of our second-strike missile forces to a surprise nuclear attack, and the ability to conduct nuclear warheads for defense against satellite forces and other terror weapons.

Senate support for an atmospheric test ban is the one notable exception to the dogmatic attitude of Congress toward disarmament proposals and to the Arms Control and Disarmament Agency. ACDA's work is being restricted. It is being accused of promoting disarmament proposals and of neglecting that the Senate has passed legislation prohibiting ACDA from using its funds "in part for the dissemination within the United States of general propaganda in support of any [pending] legislation concerning the control of arms control and disarmament agency."

Sen. J. William Fulbright (D-Ark.), chairman of Senate Foreign Relations Committee and that while he consulted with the Senate Foreign Relations Committee, "members were subjected to what appeared to be a highly organized campaign. No other legislation or proposal handled by the committee has provoked such activity."

The outcome, it is that the House will follow the lead of the Senate and keep ACDA on the basis of a temporary agency. The Senate authorized ACDA \$24 million for fiscal 1964 and 1965. The President approved the information on the Senate. He sought to have ACDA put on the same basis in most other government agencies which prevent their budget annually to Congress, without any final action.

ACDA has been authorized in fiscal 1962 with a \$1 billion appropriation. It received \$55 million for fiscal 1963. The President used \$15 million for fiscal 1964.



## Dispute Among Large Carriers Clouds Role of U.S. Comsat Corp.

Washington—Radio Corp. of America last week protested the "exclusive" assumption that its subsidiary, RCA Communications, Inc., has sole, identical rights to use Western Hemisphere (D-Wh), chairman of Senate Commerce Committee, and Ray Otis Horn (D-Vt.), chairman of House Commerce Committee.

The letters, written by RCA Board Chairman David Sarnoff, were the latest move in an ongoing policy conflict among the international communications carriers that is resulting from the rise of Communications Satellite Corp., now being organized as the U.S. agent of a worldwide network of communications via satellite (AW Mar. 25, p. 28). Under legislation passed by Congress last year, 95% of the firm's stock is to be owned by the public and 50% reserved for purchase by domestic satellite communication carriers.

### Best Profitable Carrier

Sarnoff declared that the subsidiary "is the most experienced and most profitable of the American international communication carriers. It has reinvested 55% of its earnings over the past 18 years in development and modernization of its facilities."

"We are now engaged in a further expansion program involving a capital expenditure of more than \$35 million. Such a program would hardly be undertaken by RCA if it wished to continue its communications business."

### Diamond Funding

Two French satellite mail ships are providing a major portion of the funding for the Diamond satellite system, launched (AW June 17, p. 36), before almost last week by the defense ministry here.

Diamond is derived from an experimental military two-stage missile, the Spalix, which incorporates a liquid-fueled first stage and solid-fueled second stage.

Spalix launch weight is 30,000 lb., and its trajectory can either be programmed before launch or controlled during flight, the ministry said.

First Spalix launching is scheduled for November.

Research research and development program is budgeted at about \$100 million, with the satellite program at \$115 million, ministry figures show.

The infancy of the landing is to be provided by CNRS, the French government space agency.

RCA is advocating acquisition of all U.S. international telephone and telegraph facilities and operations within the satellite firm (AW Aug. 13, 1962, p. 37). That would include RCA, International Telephone & Telegraph Corp., American Telephone & Telegraph Co., and Western Union Telegraph Co.

ITT President Harold S. Greenberg inferred from this "that RCA is willing to sell its international communications network" in a letter to Magnien that prompted Sarnoff's reply.

### Merger Plan

ITT is pushing for a merger of its international communications carriers—RCA, ITT, and Western Union. This would create a monopoly in the international communication services field, comparable to AT&T's monopoly in the international wire field.

Western Union is under legislative mandate to divest itself of its international cable operations.

According to Greenberg's plan, the proposed merged communications company and AT&T would use the satellite firm as "a carrier's carrier." The satellite company should not enter into competition with the carriers that use it, he said.

AT&T is supporting the status quo and plans to become a major competitor in the communications satellite company.

A satellite company, Sarnoff said in his letter to the congressional committee chairman, "could stay both as an immediate revenue base provided by the traffic of existing U.S. international communication carriers. In 1962, the total \$160 million."

### Cable Development

AT&T's program in the development of high-capacity transmission cables, Sarnoff noted, stands asymmetrically as low as the satellite firm, as now organized, can expect to compete at a profit.

AT&T's U.S. Range cable now has 48 years' capacity. A transatlantic version of an antenna cable on which the company started development last year will carry 720 channels about 15 times the capacity and the bandwidth according to J. E. Dugan, AT&T's executive vice president.

Sarnoff concluded in his letter to the committee chairman that "our satellite system will be used to carry more traffic than even the satellite firm's overflow cable traffic in the future."

### Helicopter Competition

U.S. Army has scheduled a 20-day light helicopter competition at Ft. Rucker, Ala., beginning Sept. 20 to evaluate results for a proposed program of 275 light helicopters for pilot training.

Plans entering the competition include Bell Helicopter, Hiller Aircraft, Hughes Aircraft, Boeing and T. E. Thompson Corp. of Minneapolis, Minn. Hiller will enter a second prototype of its FH-23 three-place helicopter (AW Feb. 12, 1962, p. 9), the first was destroyed in a crash last fall.

Army says it wants a light, inexpensive helicopter of single construction so that heavier equipment now used for pilot training can be retained for other duty.

## Hiller to Design Jet Rotor Tips for Army

After Transportation Research Council had awarded a \$953,000 contract to Hiller Aircraft Co. to design a rotor system for a heavy-lift helicopter powered by turboprops at the rotor tips.

The contract will be the first of a series of plans for a helicopter system, as the Hiller article if the study indicates the idea is feasible. A second phase would involve construction of a full-scale lift and propulsion system that would be tested in a wind test facility.

Schmidtberger, Hiller, Continental Aircraft and Engineering Corp., will develop its J647-1 jet engine for the program. This is the engine that powers the Air Force F-105 fighter.

The rotor system will consist of four blades each with an engine at the tip. Hiller has been testing tip-powered rotors, both with oxygen fuels and hydrocarbon fuels, since 1959.

Other firms in the field competition were Goodrich Aerospace Corp. and General Electric.

## Cosmonaut Confirms Parachute Landing

Moscow—Soviet Cosmonaut Valentin Tereshkova last week confirmed that she had by parachute separation from her Vostok 2 spacecraft.

"I landed very smoothly by parachute and the spacecraft landed very close to me—a space 400 meters (about 1,300 ft.) away," she said at a press conference during the World Congress of Women here.

Previous Soviet reports had indicated that Mrs. Tereshkova landed upside down by her parachute, but no specific description of the landing was given at the public news conference. Tereshkova, press conference (AW July 1, p. 25).



## Allison Regenerative Engine Design Shown

Navy has chosen the Allison Div. of General Motors Corp. to develop a regenerative turboprop engine which may speed responding aircraft development. Development is scheduled for the engine, designated 401 R2 is shown in model form above. If development is successful, Navy will install it on one of its propeller-driven anti-submarine aircraft. An F-4 is also interested in the engine for a long endurance, multi-mission aircraft. (AW Feb. 18, p. 45). Regenerative engine unit, but how relevant to last in assessing new engine design and engine housing efficiency. Allison completed work with the Navy, General Electric, Curtiss-Wright and the Licensing Div. of Anco Corp. (AW Apr. 1, p. 29). Allison Div. of General Motors Corp. had offered its best turbine data to all competitors.

## News Digest

Martin Co. will build infrared line-up system for the Saturn I launch vehicle under a \$427,000 contract announced last week by the National Aeronautics and Space Administration.

System will be built by Martin's Electronic Systems and Products Div. in Baltimore. For long duration, checkout flights of the Apollo spacecraft in earth orbit in 1965 and 1966.

Sad Aviation management and union leaders last week agreed on a wage increase which had threatened to halt Cessna production.

Northrop Corp. has received definitive Air Force contracts totaling \$229,577,500 for production of F-1A and F-1B fighters and F-5 jet trainers.

Radian Corp. of Anaheim, Calif., is negotiating a \$5-million, two-year contract with the National Aeronautics and Space Administration for operation of two new NASA tracking stations at Russian, N. C., and Fairbanks, Alaska. The new stations, which are expected to be in operation by September, will be used to track NASA's new generation of orbiting scientific observations and weather satellites.

Boeing Co. has received a \$790,000 contract from the U.S. space agency

for a five-month study of a laser beam concept (AW Feb. 1, p. 77).

My Robert A. Radtke recently became the third pilot to reach the state of 19 in the North American X-15 research aircraft. He attained an altitude of 256,000 ft. and a maximum speed of 3,945 mph, during a high altitude demonstration flight in the No. 5-X-15.

Also-Event Research Laboratory is conducting studies on use of space-based electronic systems for detecting spacecraft against existing radars. The system is being tested by the National Aeronautics and Space Administration's Marshall Space Flight Center.

Leaf Stepler, Inc., Santa Monica, Calif., is negotiating a contract with the Air Force to develop a space-based system for detecting and tracking the heavy-lift concept, with emphasis on increasing mobility in combat areas.

Heavy-lift vehicles include retrieval of aircraft and landing of space vehicles, transport of portable power sources, recovery of equipment from or beyond land and transport and placement of bridge piers.

Stoke by 900 distances at Brest. Stokely announced last week in a release that the firm, after two years of negotiations, has agreed to the purchase of 153 aircraft for the Anglo-French Channel supersonic transport, to the GBR 27 R, making the firm of the 50,000, scheduled for use in the T88-2 reconnaissance fighter.

French government last week approved a 50-50 ownership agreement between Henri Peter of France and Anco Corp.'s Licensing Division for contribution of a company to construction and will develop a system in Europe, Africa and the Middle East. France had bid for the plan (AW Oct. 21, p. 27) producing a four-engine, French aircraft, but agreed to the 50-50 plan with agreement by the company that, in addition to Henri Peter as president and board chairman, the company be divided into two offices, one in France and one in the U.S.

Republic Aviation Corp., Farmingdale, N. Y., has been selected by NASA to receive a \$5.5-million contract for first phase development of an advanced orbiting solar observatory. The first flight is scheduled for late 1967.

Pan American World Airways and National Airlines have agreed to change the 1964 that each airline holds in the other (AW Apr. 1, p. 41) in compliance with a Civil Aeronautics Board order issued two years ago.

McDonnell Douglas A-104 engine last week, seventh after taking off in a race and landing from the Rochester, N. Y. airport. First engine and five passengers were killed. Total of 36 persons on board were injured. 21 seriously. Flight originated in Rochester and terminated in White Plains, N. Y., and Newark.

## S-64s for Army

31 S. Army has awarded Sikorsky Aircraft a \$14.5-million contract for the S-64 Sikorsky heavy-lift helicopter (AW June 11, 1962, p. 32) and would support equipment to be delivered in the fall of 1964.

The S-64s, designated CH-53A by the Army, will be used to develop the heavy-lift concept, with emphasis on increasing mobility in combat areas. Heavy-lift vehicles include retrieval of aircraft and landing of space vehicles, transport of portable power sources, recovery of equipment from or beyond land and transport and placement of bridge piers.



# Northeast Assured Planes Until Sept. 11

By James R. Ashlock

New York—Retention of jet and turbo-prop equipment by Northeast Airlines until Sept. 11 has been assured through an agreement on a secured leasing program backed by the carrier's principal stockholders, Hughes Tool Co. (AVT 1, p. 17).

Northeast agreed to turn back two of its Convair 440s, which were returned to General Dynamics Corp. at Ontario, Calif., only in the week. However, the carrier's fleet, which is scheduled to be replaced by two 800s owned by Hughes Tool, leaving Northeast with no personal equipment of its 800s.

With the 800s were eight C-603-3 engines on lease from General Electric. Northeast was denied ownership of six General Electric engines on the remaining four leased 800s under conditions of the interim agreement backed by Hughes Tool.

## DC-6 Sales

Vienna-Aeromachs, Ltd., also agreed to withhold acquisition of Northeast's new Vincennes, at least until the September deadline. However, Northeast has agreed to seek immediate sale of one of its DC-6 aircraft to raise cash for partial settlement of the \$7 million in overdue payments to Vienna for the Vincennes.

Treasury asked from representation by the three engine and airframe manufacturers that in a meeting at Boston called by Cos. Endreth Percholy of Massachusetts. Among those present were several senior New England governors and Sen. Edward M. Kennedy, the President's brother.

In an earlier meeting, Sen. Kennedy had personally requested that Northeast be allowed to keep its equipment in the interim of continued air service to New England.

However, he did not intervene in discussion at the second meeting when it became evident that agreement was being avoided.

Specific details were not revealed, but Hughes Tool evidently provided a more acceptable proposal than it had earlier. It had first suggested that carrying debt on the equipment be written off, and that Northeast be allowed to keep the planes but possibly for approval hold the normal lease in private sale.

In its second offer, Hughes Tool requested to suspend, until the end of the 800s, and established the Sept. 11 deadline for release of the other four. In addition, it consented to rental payments were close approximating the \$15,000 average monthly lease rate on

the 800s aircraft, and to a comparable arrangement on the engine lease. The airline backing the request lease, Hughes Tool also agreed to pay off a portion of the existing equipment debt. None of the creditors plan to write off any portion of the debt.

Besides the \$7 million due on the Vincennes, Northeast owed \$4.6 million on the 800s aircraft and \$1.3 million on the engines.

## Hughes 800s

Hughes Tool is expected to provide two other 800s at once, currently in storage at Ontario, Calif., to Northeast. Consideration is being given to modifications of these aircraft modifications that might include installation of General Electric C-603-3 engines engines.

Although Cos. Percholy's calling of the meeting was instrumental in bringing the parties together, threatened loss of Northeast's service in New England now appears to have a less immediate possibility.

New England routes are almost entirely served with prime equipment, including Douglas DC-6. Loss of the

jet and turbo-prop aircraft would not necessarily mean immediate disruption of jet local and regional service. Such a loss would effectively put Northeast out of its Florida route, which is a major income producer for the airline.

Alan S. Boyd, chairman of the Civil Aeronautics Board, has said that the CAB will decide shortly the question of renewal of Northeast's temporary Florida route certificate, in possible the wording of a permanent certificate. If Northeast is denied continued operation to Florida, and consequently relegated to the role of a regional carrier, it is considered certain that the airline would lose its income from its ability to remain operative.

Congressional opposition to closing subsidies provided to airlines is increasing, however.

Both Northeast and Hughes Tool now have some time to seek a larger partner for the airline, an effort that is practical only as long as Northeast remains in Florida route. Hughes Tool is expected to withdraw its General support, making federal subsidy even more suggestive for Northeast.

## Three Carriers Indicate General Approval of Pan Am Fare Proposal

New York—General approval of Pan American World Airways' proposal for lower transatlantic fares (AVT 1, p. 17) was expressed by three of the American carrier's foreign competitors last week.

However, two of the three airlines questioned whether the Pan American proposal is really a genuine fare reduction move, or simply a pretension effort that would further complicate the current fare structure.

British Overseas Airways Corp., Airline and Scandinavian Airlines System agreed that fare should be lowered. BOAC and SAS "welcomed" the Pan American proposal, explaining that the proposed \$160 monthly fare is equivalent to that already available on BOAC flights between England and the United States.

Officials of BOAC said that Pan American's suggestion would receive serious consideration at the next later national Air Transport Union rate conference this September in Salzburg, and suggested that "large fare" in some form will be recommended for the approval of all governments.

Fabrizio Serrin, Airline's general manager for North America, said his carrier feels that the Pan American pro-

posal does not go far enough toward simplifying the fare structure. The Italian carrier is working on its own lower-fare proposal, he said.

"While we feel there is a pressing need for reduced fares, we do not think the best way to go about it is to introduce still another type of service adding another level of traffic," Serrin said.

Alitalia objects to Pan American's plan for continuing freights and container service over the same routes where it would introduce the lower "fares" fare. This is a "padding" another path to the old fare," Serrin said.

"The public, the travel agent and our own traveling employees could better be served by the adoption of two fare brackets—first class and consequently probably second class," he added.

Serrin also criticized Pan American's proposal for withdrawing meals and "other amenities" on the 5100 flights.

As aviation has the foundation upon which Alitalia has built its reputation and it is against the Italian nature to eliminate them," Serrin said, adding that "it is too long for persons to travel without having some food and refreshment."

## Airline Income and Expenses—April 1963

| In Thousands of Dollars                     | OPERATING REVENUES |               |              |              |                 | Total Operating Expenses | Net Profit (or Loss) |                |
|---|--------------------|---------------|--------------|--------------|-----------------|--------------------------|----------------------|----------------|
|   | Passenger          | Cargo         | Other Mail   | U. S. Mail   | Federal Subsidy |                          |                      |                |
| DOMESTIC AIRLINES                           |                    |               |              |              |                 |                          |                      |                |
| American                                    | 26,478             | 2,376         | 93           | 723          |                 | 29,672                   | 28,880               | 1,598          |
| Boeing                                      | 8,402              | 379           | 107          | 147          |                 | 7,948                    | 7,664                | 185            |
| Continental                                 | 5,344              | 101           | 86           | 140          |                 | 5,117                    | 5,074                | 45             |
| Delta                                       | 17,331             | 918           | 301          | 343          |                 | 18,844                   | 17,124               | 1,420          |
| Eastern                                     | 35,522             | 1,372         | 341          | 444          |                 | 37,679                   | 38,498               | (816)          |
| Norfolk                                     | 8,935              | 195           | 56           | 157          |                 | 9,343                    | 8,839                | 504            |
| Northwest                                   | 6,478              | 182           | 72           | 119          |                 | 6,851                    | 6,727                | 124            |
| Southwest                                   | 2,249              | 420           | 48           | 228          |                 | 2,945                    | 2,981                | (36)           |
| TWA World                                   | 16,344             | 1,078         | 357          | 418          |                 | 18,197                   | 16,404               | 1,793          |
| United                                      | 15,349             | 3,340         | 360          | 1,413        |                 | 20,462                   | 18,837               | 1,625          |
| Western                                     | 8,401              | 224           | 82           | 104          |                 | 8,811                    | 8,799                | 12             |
| <b>Domestic Airlines Total</b>              | <b>186,313</b>     | <b>17,308</b> | <b>1,013</b> | <b>4,103</b> |                 | <b>209,137</b>           | <b>206,925</b>       | <b>4,103</b>   |
| INTERNATIONAL                               |                    |               |              |              |                 |                          |                      |                |
| American                                    | 476                | 57            | 33           | 8            |                 | 572                      | 511                  | 103            |
| Boeing                                      | 412                | 37            | 44           | 47           |                 | 500                      | 1,402                | (1,091)        |
| Continental                                 | 477                | 31            | 16           | 11           |                 | 535                      | 4,483                | 54             |
| Delta                                       | 312                | 29            | 1            | 27           |                 | 370                      | 334                  | 36             |
| Northwest                                   | 2,618              | 151           | 1            | 87           |                 | 2,857                    | 2,872                | (154)          |
| Southwest                                   | 154                | 2             | 15           | 149          |                 | 319                      | 319                  | 0              |
| TWA World                                   | 3,419              | 401           | 367          | 493          |                 | 4,680                    | 5,243                | (563)          |
| United                                      | 1,017              | 203           | 142          | 170          |                 | 1,532                    | 1,581                | (49)           |
| West Coast                                  | 26,345             | 4,143         | 2,479        | 2,730        |                 | 35,697                   | 34,497               | 2,200          |
| <b>International Airlines Total</b>         | <b>44,441</b>      | <b>5,144</b>  | <b>2,068</b> | <b>8,379</b> |                 | <b>59,992</b>            | <b>61,321</b>        | <b>(1,321)</b> |
| LOCAL SERVICE                               |                    |               |              |              |                 |                          |                      |                |
| Allegiant                                   | 1,423              | 14            | 38           | 36           |                 | 1,511                    | 1,499                | 12             |
| Boeing                                      | 720                | 31            | 4            | 215          |                 | 970                      | 923                  | 47             |
| Continental                                 | 443                | 20            | 11           | 17           |                 | 591                      | 530                  | 61             |
| Delta                                       | 80                 | 10            | 17           | 17           |                 | 124                      | 144                  | (20)           |
| Eastern                                     | 549                | 31            | 1            | 13           |                 | 604                      | 516                  | 88             |
| Northwest                                   | 1,474              | 67            | 34           | 207          |                 | 2,182                    | 2,323                | (141)          |
| Southwest                                   | 1,468              | 64            | 24           | 24           |                 | 1,586                    | 1,540                | 46             |
| TWA World                                   | 920                | 54            | 7            | 26           |                 | 1,007                    | 1,359                | (352)          |
| United                                      | 211                | 21            | 8            | 21           |                 | 261                      | 236                  | 25             |
| Western                                     | 1,073              | 34            | 11           | 117          |                 | 1,235                    | 1,475                | (242)          |
| <b>Local Service Airlines Total</b>         | <b>7,968</b>       | <b>281</b>    | <b>149</b>   | <b>513</b>   |                 | <b>8,811</b>             | <b>8,834</b>         | <b>(26)</b>    |
| <b>Grand Total</b>                          | <b>210,062</b>     | <b>22,653</b> | <b>3,120</b> | <b>8,935</b> |                 | <b>218,439</b>           | <b>213,280</b>       | <b>4,159</b>   |
| ALASKA & HAWAIIAN                           |                    |               |              |              |                 |                          |                      |                |
| American Airlines                           | 1,002              | 20            | 219          | 27           |                 | 1,268                    | 1,011                | 257            |
| Alaska Central                              | 1,002              | 30            | 4            | 13           |                 | 1,049                    | 733                  | 316            |
| Boeing                                      | 443                | 4             | 111          | 2            |                 | 558                      | 404                  | (154)          |
| Continental                                 | 16                 | 9             | 4            | 7            |                 | 36                       | 117                  | (81)           |
| Northwest                                   | 59                 | 17            | 19           | 8            |                 | 93                       | 463                  | (364)          |
| Southwest                                   | 123                | 7             | 4            | 4            |                 | 138                      | 138                  | 0              |
| TWA World                                   | 44                 | 40            | 2            | 83           |                 | 169                      | 262                  | (108)          |
| United                                      | 418                | 134           | 112          | 97           |                 | 761                      | 1,130                | (369)          |
| Western Airlines                            | 34                 | 1             | 2            | 1            |                 | 38                       | 38                   | 0              |
| <b>Alaska &amp; Hawaiian Airlines Total</b> | <b>3,133</b>       | <b>418</b>    | <b>565</b>   | <b>308</b>   |                 | <b>4,424</b>             | <b>4,213</b>         | <b>(211)</b>   |
| MILWAUKEE                                   |                    |               |              |              |                 |                          |                      |                |
| Chicago                                     | 29                 | 1             | 3            | 1            |                 | 34                       | 134                  | (105)          |
| Los Angeles                                 | 1                  | 1             | 14           | 14           |                 | 30                       | 261                  | (250)          |
| New York                                    | 173                | 5             | 29           | 4            |                 | 211                      | 349                  | (136)          |
| <b>Milwaukee Airlines Total</b>             | <b>203</b>         | <b>7</b>      | <b>46</b>    | <b>19</b>    |                 | <b>275</b>               | <b>744</b>           | <b>(273)</b>   |
| CANAL & OTHERS                              |                    |               |              |              |                 |                          |                      |                |
| American                                    | 44                 | 16            | 16           |              |                 | 76                       | 110                  | (36)           |
| Boeing                                      |                    |               |              |              |                 |                          |                      |                |
| Continental                                 | 872                | 2,350         |              |              |                 | 3,222                    | 3,371                | (149)          |
| Delta                                       | 1,116              | 2,014         |              |              |                 | 3,130                    | 3,300                | (164)          |
| Eastern                                     | 444                | 7,709         |              |              |                 | 8,153                    | 8,689                | (536)          |
| Northwest                                   |                    |               |              |              |                 | 1,701                    | 1,976                | (275)          |
| <b>Canal &amp; Other Airlines Total</b>     | <b>1,476</b>       | <b>5,120</b>  | <b>330</b>   |              |                 | <b>6,926</b>             | <b>8,237</b>         | <b>(1,431)</b> |

Prepared by Ben S. Rice



ONE OF THREE Batach-built Vickers Viscounts 800s (right) produced by LOT Polish Airlines is shown parked alongside a Soviet-built IZS turboprop transport at Warsaw-Gdansk Airport. One of LOT's Viscounts was lost in a crash last December.

## Polish Carrier Plans Start of Jet Service

By Edith Waldorf

Warsaw-LOT, international Polish airline, hopes to introduce its first jet service for most medium and long range operation in 1964 or 1965.

At the moment, Poland's 44-passenger Tupolev Tu-154 transport, powered by two Soloviev turbofan engines, and the newer 168-passenger Ilyushin Il-62, powered by four turbojet-powered turboprop engines, appear to be favored among several candidates to fill LOT's requirements for approximately 10 medium-range and 5 or 4 long-range jets, respectively.

The airline also has a requirement for a fourth Ilyushin Il-62 or third Vickers Viscount turboprop aircraft to serve the carrier's longer medium-range routes as a replacement for the Viscount 800 which crashed during an approach at Warsaw some time it had returned service with LOT last December (AW Dec 24, p. 27).



LOT'S VISCOUNTS, one of which is shown above being serviced at night, are replacing the carrier's four Convair 440s over most of its longer medium-range routes.

It was the first of three of this type to be delivered by Batach Aircraft Corp as a replacement for LOT's aging fleet of four Convair 440s operating over most of the carrier's medium-range services.

Under the airline's original planning schedule, LOT had hoped to integrate its first jet service with the East German Type 152 medium range transport built by VEB Flugzeugwerke at Dresden.

This plan was voided when all East German aviation projects, including the 152 development program, were scrapped in the spring of 1961 as part of the government's reorientation of industry. (AW Aug. 14 1961, p. 28).

LOT saw the recent dog problems developed by Britain's Vickers VC 10 four-jet airliner, at first considered here as the best Western prospect for the airline's expanded transatlantic service, has forced the carrier into a wait-and-see attitude before making any final

decision on buying manufacturer aircraft.

"Our resources are too limited to take any risks," LOT Commercial Director Kazimierz Nowinski told Aviation Week & Space Technology. "We hope to benefit from the experience gained by other operators that can better afford such experiments before we decide on either the VC 10 or B-62 for our services planned not only to North America but to various points yet to be determined in Southeast Asia also."

Loss of the five of three Viscounts ordered to replace LOT's four 40-passenger Convair 440s made it necessary to reorganize the airline's entire 1963 flight schedule according to Nowinski.

For example, it was planned to introduce a new twice-weekly Viscount round-trip service this spring between Warsaw and Stockholm via Gdansk, Poland's Baltic port, with one of those light subsonic jets extending to Helsinki. Under present planning, the opening of the Scandinavian route will not be possible until about April 1, 1964.

Although current negotiations for landing rights are expected to be successfully concluded within the near future, LOT also is deferring the extension to look of its new Il-62 encounter.

Warsaw-Berlin-Alberta-Cross round-trip service (AW June 17, p. 50) pending delivery of a substitute for the lost Viscount.

According to one LOT spokesman, the findings of the investigating committee which examined the possible cause of the accident are inconclusive. Several possible factors were cited, however, including:

- Misallocation of the airport's existing and a consequent spurious reading. Landing approach was made at an unusually slow speed.
- Fatigue of the take-off crew in the Viscount's tail assembly, which

may have prevented proper reinforcement of the control surfaces of a critical control.

- Lingering while the aircraft flew a landing pattern for 20 min after having aborted the initial landing attempt.

Other Warsaw sources attribute the crash to pilot error and stress that on the approach they saw the Viscount flap for landing after it was still several hundred feet above the ground. It then fell to the ground and burst into flames, according to these observers.

In addition to the two remaining Viscount 800s, three Il-62s and four Convair 240s, LOT operates a fleet of 17 Il-14s and 16 Li-2 turboprop aircraft. The latter now are used exclusively on the carrier's domestic network.

Conversion of six of the Il-62s from 26 to 32-passenger configuration recently was completed, and the remaining 11-62s presently are being given the same additional seating capacity.

Despite its present hardships in its struggle to reestablish itself, the carrier is making some progress.

Compared with a total of 304,632 passengers and 4,623,125 lbs of cargo carried in 1961, 245,704 passengers and 5,407 U.S. tons of freight were transported in 1962. In 1963, aircraft movements at Warsaw-Gdansk Airport totaled 12,716 as compared with 14,417 last year.

To meet modern transport aircraft requirements, the length of Warsaw-Agryz's first concrete runway has been extended from 6,780 ft to 9,930 ft.

A new hangar also has been added to the existing airport buildings. Measuring 768 x 191 x 48 ft and enclosing 2,650,000 cu ft, it can accommodate the airline's three Il-62s and seven Il-14s simultaneously. According to LOT, it is the largest of its kind in Europe.

Work began last fall on the reconstruction and modernization of Warsaw-Gdansk Airport. Estimated cost of the project is about \$8.5 million, and it is scheduled to be completed some time in 1965.

Situated between Warsaw-Gdansk and Krasno and covering a total area of about 1,500 acres, it will in future serve both centers and enable the present separate Krasno airport to be closed as soon as the new one is completed.

The new one-third terminal building is being reconstructed in three stages: passenger terminal, administrative and technical facilities and the freight and mail station. At present, 12 aircraft can be accommodated on the apron in front of the existing terminal building, but on completion of the project a parking area for a maximum of 10 aircraft will be available.

LOT says it expects to be able to



LOT'S NEW HANGAR at Warsaw-Gdansk Airport can accommodate three Il-62s and seven Il-14s at one time and is the largest nonmilitary hangar in Europe, according to LOT. Il-14 is shown in the hangar for engine servicing.



ONE OF LOT's three Il-62s is shown on the ramp at the Warsaw-Gdansk Airport. Il-62s can carry of five and 54,121 passengers. Maximum speed is 446 mph and maximum range is 7,920 mi. LOT is seeking a fourth Il-62 to complete its fleet.

handle about 70 aircraft movements an hour and approach nearly one million passengers annually. When the new airport opens next summer in 1965.

## LA Airways Reports 1962 Earnings Rise

Net earnings for Los Angeles Airways in 1962 totaled \$50,857 after taxes and special credits compared with \$46,208 in 1961.

The helicopter carrier whose fleet includes four Sikorski S-61 turboprop aircraft, reported operating revenues of \$2,611,870 and expenses of \$2,192,107. This compares with an operating income of \$1,851,704 and expenses of \$1,964,154 in 1961.

Mail income including subsidy, rose to \$3,942,890 in 1962, up from \$1,716,199 the previous year. The increase was attributed to Civil Aeronautics Board's establishment of mail rates effective July 1, 1962 and include \$11,074 in retroactive mail payments from Aug. 1, 1961.

Passenger revenues totaled \$475,821 in 1962, compared with \$246,433 in

1962. Long term debt, consisting of 41½ percent mortgages on the four S-61s, \$2,148,271, and including the \$300,530 to be paid in 1963. The airline is paying off its debt in installments of \$25,100 with a maturity date of Nov. 21, 1971.

Retroactive mail payments, plus accounting which resulted in a reimbursement of payroll taxes, brought increased earnings as of Dec. 31, 1962, to \$498,771 compared with \$468,856 in 1961.

Elimination of unprofitable services in 1962 caused revenue passenger index there to drop 5.55% to \$40,899. Total hours flown dropped to 7,872 compared with 9,608 in 1961. However, average volume rose 56.97% to 77,531 feet.

The carrier's S-61s operated an average of 2.53 in daily, while its piston S-55s flew 2.80 in daily.

C. M. Bellows, president of the airline, and the S-61s and helped others a 33.4% increase in passenger volumes during the first five months of 1963, compared with the same period of 1962.

## AIRLINE OBSERVER

• **Cord Associates Board** said it expects that the U. S. continue to third time in the restriction of northbound traffic denied to and from the U. S. he expects the carriers, although CAB Chairman Alan S. Boyd recently reached an agreement in principle with the British Air Ministry that calls for more business in the transportation of such traffic. The agreement was reported to be the approval of KLM and SAS, chief opponents to U. S. demands for northbound restrictions. Such freedom is defined as that traffic which is carried by a flag airline from its home country to a second country and then on to a third.

• **Russian** soon may place the seating capacity of Aeroflot's *Ilyushin* B-62 helicopter transport at 166. When the aircraft was unveiled last September, Soviet reports said it would carry 112 passengers. Official Russian government newspaper *Izvestia* said the B-62 has been tested "at great altitude and with one and two engines out." It adds that the B-62 will make its first long trip "in the not-distant future." *Izvestia* puts the B-62's wing span at 141 ft. Earlier reports placed the span at 165 ft.

• **Trans World Airlines** has been conducting a survey of 10 major U. S. and European cities that will serve as primary cargo hubs for the airline's three Boeing 707-320C turbojet freighters by early next year. Survey focuses traffic volume and necessary schedules, plus information on terminal facilities and ground support equipment required.

• **Foreign visitors** will have the opportunity to fly the entire U. S. and Alaska local service pattern for \$100 in a 10-day period, beginning in September. The new package, stemming from the original "Domesticland" tour introduced two years ago by **Boomer Air Lines**, offers unlimited travel on state-sponsored U. S. local service airlines, plus Alaska and Canadian airlines.

• **CAB Chairman Boyd** has stated New England routes that there will be no interruption in local or service in that area if Northeast Airlines loses its Florida-New York route (AW July 1, p. 37). Boyd said that if Northeast's service collapsed, it would be replaced within 45 hr.

• **Federal Aviation Agency** has extended its positive operation control of aircraft above 24,000 ft. to cover the area above Missouri, Illinois, Oklahoma, Kansas, Nebraska, Iowa, North Dakota, Wyoming, Colorado and Utah. Traffic control control at Kansas City and Denver will provide the control. Action brings approximately one-third of the airspace above 24,000 ft. over the continental U. S. under positive control.

• **Indian Airlines** plans to put the first of its three recently ordered Sud Caravelle jet transports into service Jan. 1 on its New Delhi-Bombay route. The airline hopes to operate three Caravelle flights daily on the route and eliminate flights by Boeing 707s leased from Aer India.

• **Surge of air orders for flight equipment** by U. S. domestic trucklines can be expected shortly. Steady traffic growth indicates that the problem of overcapacity may have been temporary, and that as a long-range basis, airlines may have under-purchased recently rather than over-purchased in more optimally believed. One reduction could run a seasonal over-purchase problem, as the industry is clearly faced to the rising gross national product and an expanding ground economy. Any break in the economy would delay traffic growth and could cause another airline depression. Failure of the industry to develop new travel markets would compound the difficulties and could worsen the over-capacity state.

• **Wall Street** broken in changing their low opinion of airline stocks and are now strongly recommending U. S. carrier issues for general portfolios.

• **FAA** last week awarded a third contract in the development of a two-seat glider-type and tandem to **Homebased Telephone and Telegraph Laboratories**. Progress calls for an ILS that will serve airports where air traffic is not sufficiently busy to justify installations of conventional ILS. Previous contract awards for the project were let to **Aurora Instrument Laboratories** and **Somerset Laboratories**.

## SHORTLINES

• **Bombardier's Santa Cruz Airport** has introduced traffic control restrictions during the current aviation season as an outgrowth of an Airbus Douglas DC-8 crash there during the previous season. Restrictions prohibit aircraft below 7,000 ft without positive radar control.

• **Continental Air Lines** spent of Boeing 707 series 30 units, jet flights from Los Angeles on July 6, 5 and 6 were sold out on 10 days. Total of 2,700 seats on the special flights, planned for the light traffic period, were offered for sale and companies officials have estimated that 5,000 seats would have been needed to handle the demand.

• **Cord Associates Board** chairman Alan S. Boyd has told *Mohawk Airlines that one of the BMC 111 jet transport would be required eventually in the Board of, at *Mohawk* contends, the operation would require other than current safety need. He added that the staff has been had an opportunity to analyze the *Mohawk* presentation on the jet operation but will be in a position to make "an informed judgment" when the staff study is completed.*

• **North Central Airlines** has been authorized by the Cord Associates Board to continue serving *Manitowish and Sheboygan*. Why through the *Manitowish Municipal Airport*, rather than provide additional service at the *Sheboygan* airport.

• **Pan American World Airways** will inaugurate direct service from New York to the African republic of Guinea on July 35 with once-a-week flights on a route via London and Rabat. *Monrovia* flights will continue on past Conakry, capital of Guinea, to *Moukoko*.

• **Pan American World Airways** is co-operating with the Federal Aviation Agency in testing an aerial navigation system on transatlantic flights. The 50-ft. test unit has been installed on a Pan American jet flying regular schedules. Progress is being financed by a \$22,500 contract awarded by FAA.

• **United Air Lines** has declared a regular quarterly cash dividend of \$1.57 per share on preferred stock and \$2.11 cash a share on common stock, payable Sept. 3 to stockholders of record on August 15.

• **Western Air Lines** earned a record profit for the five-month period ending May 31 of \$2.9 million, or \$2.04 per share. This compares with \$1.8 million in the same period of 1963.



**We've got 4,500 pounds by the tail**

Picking up a load and lowering it whole — that's having to look down — will be a unique feat for a helicopter. This new technique of aerial sea-ramp lifting will add important new capabilities to the already impressive versatility of the Boeing Vertol V-22. The ability to lift a 4,500 pound load (in this manner) is one of the many advantages of the tandem rotor configuration. Helicopters have an impressive new range

of operating flexibility when they're loaded from landing-air loading. They can pick up heavy objects such as a solid equipment, and pallets for personnel and supplies in any kind of terrain — jungle, marsh or mountains. They can extract them from space hardware from the water. They can change pick-up or drop even on an oil and since having made a pickup, they can get the most and payload made the cabin who is the longer... and powered at rated output.

The Boeing Vertol V-22 is another example of creative engineering. Forward thinking weapons system program management and the vast resources of the Boeing Company.





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ENGLAND CANADA AUSTRALIA

## PSA Business Traffic Proportion Grows

By Harold D. Watkins

San Diego-Pacific Southwest Airlines, an interstate operator, must deal with regulatory problems even though it operates outside the jurisdiction of the Civil Aeronautics Board (CAB July 1, p. 45).

Earlier this month, the CAB ordered the airline to stop carrying passengers transferred to it in another airline when the PSA flight is a direct connection with an interstate carrier. The Board's order resulted from a complaint filed by Western Airlines, which said PSA had violently discontinued the service, which stemmed directly from antitrust arrangements with supplemental carriers. Participation in antitrust operations immediately places the carrier under CAB regulatory authority.

Another problem is a bill pending before the California state legislature that would give the state's Public Utility Commission greater control over airfares. While PSA supports some aspects of the bill, it fears too much interference in its operations.

### Management's Goal

Meanwhile, PSA's management is focusing on its principal aim: to keep the carrier a leader in the West Coast air travel market. To achieve this, the airline constantly adapts its operations to meet changing demands.

A gradual shift in PSA's sales and advertising approach began with the advent of the Electra, and has intensified as the last year as so "We've given up the bad old," PSA President J. Lloyd Andrews explained. Now, instead of concentrating on low prices on radio spots and billboards, PSA relies a somewhat softer approach, emphasizing frequency, convenience and "jet power," in addition to economy. "Our slogan is now 'Cheap, and let only our destination offices in San Francisco. To keep 'no-shows' to a minimum, callers usually are referred to travel agents to pick up their tickets unless the request is made on the day of the flight, in which case passengers are asked to get to the check-in counter 10 min. before flight time. PSA pays agents 8% commission, compared with the usual 5%.

As a "result" tactic, plus a refund to the company's 7,000 credit holders. Tickets are sent via telex per bus reservation control to special printers at each check-in counter where they are held for card-holding passengers, who are called at month-end.

A following program was initiated to cover the heavy expense of modern-

the great San Francisco-Los Angeles run, Western Airlines at least of late very ordered a "Thriller" all-cabin service with petco-powered Douglas DC-8Bs (AW June 15, p. 45). One-way fare of \$12.95 (plus tax) under PSA's \$13.50 is a shade, and the difference is a necessary flight to Los Angeles. Western lowered its tariff to \$11.40 this February. The original schedule called for 84 Thriller flights weekly. That has gradually been increased to 128. Western closes the last letter has been to its 75 DC-8B flight to Los Angeles in 1 hr 35 min. between the two cities, as compared with PSA's 1 hr for the Electra.

One more low fare challenge is offered by Trans California Airlines, another interstate carrier which last July began serving Oakland, Los Angeles International Airport, Burbank and San Diego with petco-powered Lockheed Constellation 748.

PSA's maintenance of maximum control in one place under the direct supervision of top management at San Diego was another move in the carrier's general policy of attempting to make air travel as uncomplicated as it can, not only for passengers, but for the company. Early constant back, for instance, have resulted in simplified night and balance forms, and finally with rate conditions has reduced flight planning to a minimum of effort.

The carrier's maintenance center is expected to eliminate maintenance and repair areas that were inevitable in the previous system where maintenance control was duplicated in San Diego, Los Angeles and San Francisco.

### Ticket Offices

In line with low overhead policy, the company maintains no ticket offices outside the airport itself in Los Angeles or San Diego, and has only destination offices in San Francisco. To keep "no-shows" to a minimum, callers usually are referred to travel agents to pick up their tickets unless the request is made on the day of the flight, in which case passengers are asked to get to the check-in counter 10 min. before flight time. PSA pays agents 8% commission, compared with the usual 5%.

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A following program was initiated to cover the heavy expense of modern-

ization and equipment. One important step was a February stock split, after which, which resulted in the sale of 311,000 shares 100,000 of which were owned by the company. Remainder was sold by original shareholders. Proceeds to the company were approximately \$1.7 million, which, together with other funds and a new 745 bank loan of \$4.32 million, was used in late February to refinance these separate, long-term investments totaling about \$7.6 million.

Approximately \$4.5 million of this amount was in a 5% note which was given in January, 1963, when the company purchased the three Electra it was leasing. An \$830,000 discount was realized by prepaying this note. The remainder of the cash-in-hand notes which were applied back 6% interest.

Purchase of the sixth Electra at a cost of \$1.9 million was financed per month with another 55% bank loan of \$1.7 million.

The new bank loans are secured by mortgages on the aircraft, engines and related equipment.

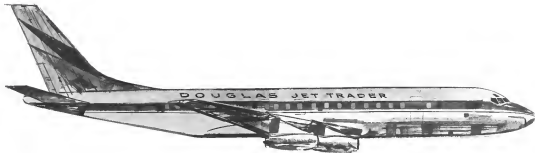
### Financial Report

As of the May 31 financial report to shareholders, PSA also had \$425,000 in 64% convertible notes outstanding with a \$10 a share conversion price. On that date, PSA had 550,000 shares of common stock outstanding, with another 1,200 shares of common stock upon conversion of the 64% notes.

Depreciation on equipment is expected to cover more than cover depreciation of the long-term debt as they rise due. Heavy reliance on cash flow from depreciation is indicated by the 1962 first-quarter report, which showed current assets of \$1,617,000 and current liabilities of \$5,376,000.

First-quarter operating results, according to the latest report of the PSA staff. Revenues, added by the fifth Electra, were up 42% to \$3,900,000, and savings rose by 15% to \$1,700,000 to \$460,000, or 10 cents a share. Andrews said that PSA is projecting a 35% growth rate in revenues over the next couple of years. "Rising population in California, coupled with greater use of air travel in PSA routes, are among the factors behind the anticipated growth. Passenger traffic will not only rise in volume in flight, additions to routes, airports or other significant changes in the company often has requiring additional assets.

(This is the second of two articles covering Pacific Southwest Airlines.)



## COUNT ON DOUGLAS FREIGHTERS TO "DELIVER THE GOODS"

THEY DO A "COME-THROUGH" JOB EVERY TIME. LOOK AT THE RECORD

**DC-6Fs** are the first pure jet freighters. And they carry cargo at fastest speed and lowest cost per ton mile in aviation history.

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- 1 The Spey powered BAC One-Derby has been ordered by British International Airways, Malayan Airlines, British United Airways, Kuwait Airways, Central African Airways and Air Lanka.
- 2 The Spey has completed over 11,000 hours development testing, including nearly 4,000 hours in the de Havilland Trident.
- 3 Flight testing is now proceeding at the Blackburn Buccaneer S2. This aircraft has been ordered by two governments.
- 4 Superpowered de Havilland Tridents are being delivered by British European Airways this year.

## The Spey is winning world acceptance

Production engine deliveries of the Spey are building up fast. And more and more airlines are showing firm interest in the engine for their re-equipment programmes.

In its design and rating the Spey is based on Rolls-Royce's unique experience of commercial turbine operation. This is your assurance of the operational economy vital for profit-

able use of the short-haul jet.

The Spey will bring to jet travel all the inherent qualities of the Dart, which powers the Vickers Viscount, the Grumman Gulfstream, the Fairchild F-27 and the Whitworth-Gloster Argosy—all in service in North America.

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Second, third and fourth prototypes. Doesn't Mirage 4A look like a weapon shape in a really amazing, 60-foot viewing stand at the Paris Air Show. These prototypes are slightly larger and closer to the production version than the first prototype that was



lost in a crash earlier this year. Gross weight of the Mirage 4A, which has Mark 2 capabilities, is 60,000 lb. Dimensions of the later prototypes are length 77 ft., span 30.5 ft., and height 35.5 ft. The airplane carries a close-range nose,

## Three Mirage 4A Prototypes Fly Formation, Demonstrate Landing, Takeoff Performance



Large body takes a visible shape of weapon on the third prototype (above). Smoke puff trails from nose leading edge of the fourth prototype (below) just after initial touchdown in a 90 deg. approach on the runway at Le Bourget Airport.



Afterburners lit on its two 15,000 lb. thrust SNECMA Atar 9K turbojet engines the Mirage 4 begins its takeoff roll (above). Drag parachute and wing-mounted speed brakes aid deceleration after landing (below).





# How Goodyear "Engineered Value" solves today's flight problems

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**PROBLEM:** Ice-easy heat of wheels, brakes and tires.  
**SOLUTION:** Goodyear wire tires and studs.

**ADVANTAGES:** Withstands prolonged exposure at low-temperature. High heat coefficient of friction of dry skid system. Shorter landing runs. Gives "hot-core" aircraft landing capability.



## FOR THE NAVY



**PROBLEM:** Wheel corrosion in naval aircraft.  
**SOLUTION:** Goodyear plastic wheels.

**ADVANTAGES:** Unaffected by marine environment. Resists mold/mildew. Competition with metal wheels in areas of weight and cost. Standard inspection techniques. Helps protect tires from brake heat.



## FOR PRIVATE FLYING



**PROBLEM:** Icing conditions.  
**SOLUTION:** Goodyear bogard.

**ADVANTAGES:** Reliable—no moving parts. No maintenance. Patented electrical heating element prevents solid spots or hot spots. Conforms to wing, tail and fuselage surfaces. Heats instantly.



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**PROBLEM:** Protect remote radar antennas.  
**SOLUTION:** Air-dropped inflatable radomes.

**ADVANTAGES:** Protect radar antennas from wind and weather. Can be erected by air-man even in half hour. Can be air-dropped in sections. Inflatable, already proved in other radar applications.



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# T58

## PICKED TO POWER ANOTHER

U.S. Air Force selects Bell helicopter powered by General Electric T58 engine for missile site support missions. Engine produces 1,250 horsepower, weighs 300 pounds, has 800 hour TBO record in Air Force service.

10-14



General Electric T58 Powers Them All



First prototype of the Fieseler Storch C-56A (top left) is flown at the Paris Air Show with the second (right) on the second prototype (right). Fieseler's Storch C-56A is flown at the Paris Air Show with the second (right) on the second prototype (right). Fieseler's Storch C-56A is flown at the Paris Air Show with the second (right) on the second prototype (right).

## First, Second Transall Flown in Paris Demonstration



Top and bottom views of the first prototype (above) show wing planform details, and (left) design of new loading crane door tail structure and twin, tandem heavy main landing gear for unimproved field operation. New feathered left engine (above, left). Landing configuration (left) with gear extended as shown in photograph below.





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## BUSINESS FLYING



**NORD M. 640 SUPER EMBUSARD**, powered light twin turboprop, makes a single engine, low-level ferry. Aircraft powered by two Turbomeca Bastan 6 turboprops, carries 26 passengers. Miles Master (top plane) is a cable-tether, two-seat turboprop trainer, and is powered by Turbomeca Marboré 24.



**PIAGGIO-DOUGLAS PD-808 Viper Jet**, shown in model form (left), is powered by two British Bristol Siddeley Viper 101 turboprop engines. Civil version of SIFA 211 Autilage (AW June 24, p. 76) shown top, fitted with two water cabins to allow for single entry door.



**MODEL OF POTEZ 69** (above right), shows derivative basic design engine Potez 140 400hp as marketed in the U.S. by Turbo Flight, Inc. French government has ordered two Potez 69s.



**PIRELLA Berth PD 140** Marcor turboprop version of the Berth Basic, is shown during approach at the Paris air show.

## Jets Top Business Plane Display at Paris

By Herbert J. Calman

**Paris**—Two new executive jet turboprops—the Dassault Mercure 20 and the de Havilland DH 121—captured most of the business flying interest at the Paris Air Show, topping a display that featured five new designs with a chance of reaching the hardware stage.

On the whole, the business flying section was dominated by designs now well established in various national markets, although the French company of S. A. Ingens Matis unveiled a new airplane that has been built under conditions of extreme scarcity and will fly for the first time next month.

The aircraft is the two-engine "jetuipelle" Matis 160, the first of what Ingens Matis hopes will be a family of planes topped by the Nivert

2000, an executive and business plane powered by a turboprop and a turbojet engine.

Another new French design is, in effect, a Potez 140 turboprop scaled down to a two-engine executive plane, which the firm, Pirella-Berth-Pierre is proposing to the French air force as an aerial production trainer.

The Matis 160 prototype was built at Ingens Matis's main aircraft development plant at Bourges-Bellancourt (Sona) and unveiled on opening day of the 1965 Paris air show at Le Bourget.

The company has designed a cabin version but has little hope of interesting French in designs as large until the prototype has gained considerable flight test time. The model now is in price for worldwide sales in the civil market.

All-steel Matis 160 is a low wing monoplane, which can be fitted with five or six seats. Two Turbomeca SO-100 200-hp fuel-injection engines are mounted fore and aft along the airplane's centerline. The tailplane, mounted on top of fuselage, has a horizontal stabilizer.

Clear wing is slightly swept back and is a tapered planform containing two spars. Span is 76 ft. 1 in. and the wing includes integral tanks which hold a total of slightly more than 95 U.S. gal. Landing gear, built by Alouette, is a tricycle type, with main wheels folding and retracting into the wings and the nose gear retracting forward into the fuselage. Propellers, built by Breguet, are constant speed, full feathering.

Ingens Matis said design aims call for a maximum speed at sea level of 212





**LOCKHEED ELECTRA.** Lockheed's popular turbo-prop is equipped with RFG brakes which deliver higher torque without fade, and slower, more even, lining wear. Other RFG products on the Electra include tires, seals, engine shoes, propeller heating elements.



**BOEING 707-320.** The big intercontinental passenger models of the 707 are all equipped with RFG brakes, selected for their higher capacity for fast, chatter-free stops. A major advantage of RFG brakes is their thermally balanced design.



**BOEING 720.** This medium range jet is equipped with RFG disk brakes, as well as wheels and disk tread tires. One of the reasons RFG brakes are preferred on more commercial jets is the special sintered metal linings, developed by B.F. Goodrich.



**BOEING 727.** The newest Boeing jet has special RFG brakes on both main and nose wheels, designed to meet requirements for operation from short runways. New design permits a series of short flights without delays for brake cooling.

■ More U. S. main jets and turbo-props in airline service are equipped with B.F. Goodrich wheels and brakes than with any other make. For the reasons behind this performance record, contact B.F. Goodrich Aerospace and Defense Products, a division of The B.F. Goodrich Company, Department AM-7A, Troy, Ohio.

aerospace and defense products

**B.F. Goodrich**



**POLISH ZDRIF**, high performance glider on display at Le Bourget, is now in production

mph and cruise speed, using 7500 power, of 264 mph at 7,540 ft. Minimum speed with one engine out at 1,750 ft will be 158 mph.

Future members of the Moynet family, still in the design stage, is the Moynet 730, a slightly larger version of the 360 fitted with two 200-hp engines turning three-bladed propellers. It would carry six passengers.

Most sophisticated airplane in the Fagor-Moynet group will eventually be the Moynet 2000, a low-wing, conventional turbo-prop/turbojet powered es-



**CZECH ZLIN Tutor** Moynet is shown at the top of a loop during Paris flying display.



**CZECH ZLIN 260** is used for fun and hospital services by CSA and Aeroflot.

### Moynet 360 Specifications

|  |                                 |
|--|---------------------------------|
| <b>Dimensions</b>                            |                                 |
| Span   | 36 ft 1 in                      |
| Length                                       | 27 ft 9 in                      |
| Wing area                                    | 171.2 sq ft                     |
| Engines                                      | Two Lycoming R3600, 200 hp each |
| Power loading                                | 11.11 lb/hp                     |
| Wing loading                                 | 12.8 lb/sq ft                   |
| <b>Weights</b>                               |                                 |
| Empty, empty                                 | 2,219 lb                        |
| Fuel load                                    | 1,600 lb                        |
| Gross weight                                 | 3,819 lb                        |
| <b>Performance</b>                           |                                 |
| Maximum speed, sea level                     | 212 mph                         |
| Cruise speed, 7500 power                     | 264 mph at 7,540 ft             |
| Stall speed, 65% power                       | 199 mph at 18,660 ft            |
| Rate of climb                                | 1,450 ft/min                    |
| Rate of climb, one engine out                | 182 ft/min                      |
| Service ceiling                              | 22,470 ft                       |
| Service ceiling, one engine out              | 9,075 ft                        |
| Minimum takeoff distance over 50-ft obstacle | 1,390 ft                        |



**ALL METAL**, Moynet 160 (shown) is a low wing monoplane with five in its seating capacity. Two Lycoming R3600, 200 hp, turbocharged engines power it, one mounted in the nose and one in the tail along the airplane's centerline.



**ZIMMERING GRAZ-FALKE** is the Zimmering, shown approaching a landing (shown) is fourth version of an Austrian low-wing light twin. Powerplants offered are 180-hp Lycoming R3600BIA or 200-hp Lycoming R3600AIA. Fuel system optional.

cratic transport which will carry eight passengers at speeds up to 455 mph.

New standard turbo-prop engine will be a Turbomeca Astazou 3 furnishing 350 chp. The aft turbojet powerplant, mounted on the tail cone with a single intake bled out the upper fuselage on either side of the vertical stabilizer, will be a single Pratt & Whitney JT13A1 producing 1,080 lb thrust. The airplane will be 46 ft long, 17 ft 5 in high. Wing span is 32 ft. Gross weight will be 16,400 lb.

Fagor-Moynet has not yet avoided poor ratings, pending production schedules and future orders, but the company stresses that the entire line will be flying within the next two years.

Enthusiasts Henry Fagor, still peddling the Peter 80 four-engine jet biplane in the world market, this year unveiled the Peter 80, a two-Astazou powered airplane which bears a close resemblance to its larger predecessor.

The company has not yet made the decision to go ahead with the construction of a prototype, pending completion of surveys, but the airplane has been designed to carry eight persons. Cabin will be pressurized. Dimensions are: length, 36 ft; height, 35 ft; and wingspan, 46 ft.

Noted only in the turbojet-powered executive transport field is the Moynet's ME-P 148 Jet Tutor, a line to aircraft supplier shown in model form. Powerplants are two Turbomeca Marbore 2s of 560 lb thrust each. Jet Tutor, which will be substituted

to six forms throughout the world as a liaison and training aircraft, is a low-wing, all metal monoplane with a T-tail. The wing is built as a single section and runs through the fuselage without a break. Tailoff weight is 5,670 lb. Dimensions are: length, 25 ft 6 in; height, 9 ft 1 in; and wingspan, including tip tanks, 26 ft 1 in. Wing area is 118 sq ft.

Two other new jets, well advanced in construction, are the Pégaso II and the Stab 105. Both were shown in model and mockup form. The Stab 105 prototype, designed to Swedish air force specifications as a transport multi-purpose airplane, is scheduled to make its maiden flight in 1975 (AW June 3, p. 29).

The Stab 105 was originally designed to take the Turbomeca Marbore 4 engine, but the powerplant requirement later was changed to the Turbomeca Astazou, a turboshaft engine. This necessitated a redesign of the air intakes because of the greater volume of air required, a task completed after lashed and wood balsa testing.

Such a building two prototypes of the high wing, T-tail airplane. The configuration was selected because of air force specifications calling for a cabin able to carry external weapons and photo stores at six attachment points under the wings.

Noted U.S. business planes shown were the Cessna Skylark twin propeller and the Aero Comm Commair jet.

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## CONTROL DATA® 3600 Computers Selected for Atlantic Missile Range

### Real-Time Computer System

The Atlantic Missile Range will place in operation a dual CONTROL DATA 3600 real-time computer system to provide data for range safety at Cape Canaveral. High internal speed in the 3600 compute module is matched by the speed with which the CONTROL DATA 3600 can accept information from multiple sources, decide which is most accurate, then compute and transmit the results in the form of a missile impact point every 50 thousandths of a second. □ The major elements of the Real-Time Computer System are two standard CONTROL DATA 3600 computers, the world's most powerful computers commercially available. Along with its high speed, another major advantage of the CONTROL DATA 3600 is the provision for modularity built into the machine. Additional memory modules, compute modules, and input/output data

channels can easily be included to handle increased data processing requirements as needed. This means that the Atlantic Missile Range will start out with a system commensurate with their requirements. As AMR's data processing needs grow in size and complexity, additional units can be included without replacing the original equipment. □ Control Data's total system capability for this real-time system is provided by the Company's **Government Systems Division**...and includes problem analysis, system design, hardware implementation, system integration, programming, installation and maintenance. □ To learn more about the 3600 and Control Data's total system design capability, contact the Control Data representative nearest you.

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Project work encompasses everything from the overall technical requirements, including administrative, facilities, and development effort. This is a broad equipment requirements. For Air Force, information, development and use of various subsystems and location systems.

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In order to qualify for these and other positions, you should have at least five years experience and, preferably, an advanced degree. Qualified applicants are invited to contact Aerospace Corporation, a non-union company, immediately. Please write to Mr. R. E. Gorman, Room 104, P.O. Box 745, San Bernardino, California.

AEROSPACE CORPORATION

## PRODUCTION BRIEFING

**Wyman-Corbin Co., Worcester, Mass.,** has received initial orders from the U.S. Navy for 15 sets of wing spars for the Douglas DC-7 short-haul jet transport. Each set will consist of four forgings each approximately 120 in. long and weighing as much as 180 lb. Deliveries will be in August.

**Cross-Corbin Industries, Inc., of Tulsa, Okla.,** has formed an Aero-Space Div. to be situated in Irving, Tex., between Dallas and Ft. Worth. The division will be located in a 120,000-sq-ft building, new under construction. Initial employment will total about 500 people, primarily machinists. Cross-Corbin is a manufacturer of heavy duty construction machinery.

**Republic Aviation Corp., Farmingdale, N. Y.,** has a \$100,000 sub contract from National Aeronautics and Space Administration to determine the structural and thermal performance requirements for a manned-test-vehicle space station.

**International Telephone and Telegraph Corp.** has merged two of its Defense-Space Group units—International Electric Corp. and ITT Information Systems Div. The new unit is called ITT Information and Data Systems Div. and is headed by Melvin H. DeBakey, former president of IEC.

**Federal Aviation Agency** has awarded the firm of Bolt, Berneck and Newman, Inc., Cambridge, Mass., a \$261,511 contract to develop strong guidelines to aid airport planners in keeping noise to acceptable levels. Part of the study will include reactions of people to aircraft noise, and their community actions to stop it.

**Acrop-General Corp., El Monte, Calif.,** has been awarded a \$2-million Air Force contract by studies in advanced liquid propellant rocket engine design. Work will be performed in Sacramento, Calif.

**Air Force Logistics Command** reports savings of \$15.7 million realized through extension of the profitable life of General Electric J47-GE-11 turbojet engines used in the Northrop F-5A fighter. Savings resulted from modifications which extended engine life and reduced need for spare engines.

**Boeing, Oshkosh, Wis.,** West

**Coast, Calif.,** has a \$5-million cost-plus-incentive fee contract from U.S. Naval Training Device Center, Fort Monmouth, N. Y., for the construction of a 100-ft-long, 10-ft-wide, 10-ft-high building for use of the first ballistic missile training facility at Charleston, S. C.

**Continental Aviation and Engineering Corp., Detroit, Mich.,** has been awarded a \$1.6-million Air Force contract for production of 169 engines for the T-37C jet trainer.

**General Controls Corp.** will develop a propellant piping system for operation in a completely environment for the Apollo program, under a \$1.5-million contract from North American Aviation's Space and Information Systems Div. The system will use cathodic arc from a propellant to detect discharging fuel and the size of it. The information will be signaled by computer to the display panel.

**Vista Services Div., of Vista Services Corp., New York, N. Y.,** will manage and operate Air Force's Air Force Ground Center land range test area and Eglin Golf Test Range in Florida under a \$7-million Air Force contract.

**Murray J. Shiff Construction Co., Tucson, Ariz.,** has been awarded a \$2-million NASA contract to build a test stand and other support structures for testing the Apollo spacecraft's payload bay system, at White Sands Missile Range, N. M.

**General Motors Corp., Detroit, Mich.,** has a \$1-million Air Force contract to provide engineering services for the Anar Light Observation Helicopter program.

**North American Aviation, Inc., Columbus, Ga.,** will build additional A-9C Vigilante aircraft under a \$23 million contract from Bureau of Naval Weapons.

**NASA** is building an instrument laboratory building at Marshall Space Flight Center, Huntsville, Ala. The laboratory will be used to design and develop instrumentation for Saturn launch test stands. Building and equipment will cost \$1.9 million.

**Acoustic Division, of Ford Motor Co.,** at Newport Beach, Calif., has been transferred to Fluke Corp., a wholly owned subsidiary of Ford. Acoustics is operating as a division of Fluke.



**POT-  
POU-  
RI**

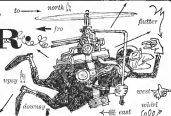
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SEE PAGE 1000000000000000

**GCC NEEDS MOON MAN**  
**Get Jobs at Moon Standard** as each LEM "moonman" will be equipped with two GCC Model 45121R summary pressure indicators. One of these 1" by 1" by 1" by 1-inch sensors will be used for submergence and pressure data. The other, a rough count device, automatically counts the times down as long as the lunar surface is being explored. The longer the time, "in hours," is indicated, the better thoroughly field tested as a flight, surface mounted pressure pickup in minute and space vehicle use.

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## BIG GCC DENVER SCORE PROMISED BY MARTINEZ

This is our year in Denver. According to our local Mancuso, Dick Mancuso, last year's low in the semi-finals will not be repeated. We think this is a useful idea for both GCC and DCC, since we're so difficult to do well that it takes to lose. And you're a better man, put your back in the GCC. Attached Denver Little League and hope that two thirds of the team doesn't drive for camp in summer in a mess of last year's performance.

**True Air Zig Zag Tack Twirl  
Skitter Crab & Skew Speed**

The GCC answer to this dilemma gives readings for forward, reverse, port and starboard speeds (or any combination thereof). It's accurate right down to a few miles per hour. Madsony forbids further hypothesis.

And budget factbook complete descriptions here. Use the following as a what

your system. The GCD system is based on multiple servers, each

to protect incoming broadcast stations from the possibility of being hijacked by a hacker, can you get a dedicated, stand-alone broadcast station controller? As you are no doubt appreciate, having the sensing end of a TAS system scrubbing that 360° needs several thousand times per minute as the end of a thin, buried, pinch-control-fiber that gets the superhigh-speed laser light loadings, can you get a stand-alone broadcast station controller for an art light computer? It's the sort of problem you automatically send to GDC.

For complete details on any typically practical working hardware-type solution to help solve true art space musicians, send us your specific computer

.....

Figure 1. Schematic diagram of the experimental setup.

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could select radio transmitting the quantum for each submarine, which will reveal interference. And it must do this quickly before the submarine is able to escape into the ocean's depths.

Submarine skippers are trained to employ unpredictable and unconventional tactics to avoid any pattern of behavior which will make their detection and destruction easier. But the long memory of a digital computer may be able to spot even faint patterns of behavior that might be overlooked by an ASW crew which has been on duty for several hours.

In the A-New integrated system, the airborne digital computer will perform many functions. It will continuously compute the aircraft's latitude and longitude, calculate optimum deployment configurations for substations, keep tabs on their location with respect to the moving aircraft and determine estimated target position from data supplied by all capable sensors.

It is expected that the computer will use statistical techniques to derive several possible courses of action, displaying these and the computed probability of success, for final selection by the aircraft commander.

Because the computer acts as a central clearing house for all sensor data as well as keeping track of the aircraft movement, it should greatly simplify the problem of loading the crew of a new aircraft coming on station. At present this must be done by voice radio and a somewhat sketchy, which can result in needless duplication of assets already parked. The means of a two-way data link, Niss expects to be able to automatically transfer the complete history of the departing aircraft's operations to the incoming ASW aircraft's digital computer.

### Data Transferral

Similarly, information on potential ASW targets available at shore or ship-based command information centers can be quickly transmitted to the advance digital computers, via data link. Radio Corp. of America currently is under contract to adapt Navy's standard AN ASW-21 data link system, originally designed for airborne intercept use, to the ASW information

Because of the low risk placed for the airborne digital computer Sperry Rand's Univac Div. is playing a major role in the A-Now program. It is responsible for modifying an existing computer, originally developed by Univac under Air Force sponsorship for missile guidance, to suit the A-10's needs.

Univac also is developing the computer programs "software" needed for the new ASW system. Modifications of the national computer system include:



**UNIVAC DIGITAL COMPUTER** will play key role in Project A-New integrated ASW defense system which Naval Air Development Center is assembling for installation on TF 14. Flight evaluation of the environmental system is scheduled to begin early next year.

addition of increased memory capacity and retention structure

The machine is a stand-alone program, together with a word-program computer, although Navy currently is using on its Grumman E-2A (WF2) and A-6A (AF2). The choice of a stand-alone program will not only provide greater flexibility for evaluating different tactics and procedures during the early flight test phase, but also will make it easier to adapt an operational system to new ASW sensors or tactics, according to M. R. Clement, Jr., Usan's A&N

### Increased Commonality

At present there is considerable difference between the ASW women stations used in current and land-based assist. NADC officials express the hope that increased commonality will come out of the A-New program and that ultimately the two types of airborne systems will differ primarily, only in the number of crew stations, not in the

System integration and display techniques being considered for A-News have been undergoing associated ASW war-gaming evaluations at NADC for several months.

These are conducted using a modified version of an existing accelerometer originally built by ACF Electronics for

This will be replaced with a more stable digital analogue test system. It will be able to simulate a larger variety of sensors and will be designed to reproduce the high speed and randomness of weather submersibles expected to be operating during the next decade. The new machine will enable Navy scientists to "fly" a simulation



## RADIATION RESISTANT VOLTAGE REGULATOR

SNAP-10A (Systems for Nuclear Auxiliary Power) is being developed for the U.S. Atomic Energy Commission to answer the demand for more reliable, higher output space power sources capable of operating for at least a year. Its potential applications range from worldwide communication and weather observation satellites to space navigation aids.

An integral part of the SNAP-10A system is an IPTT-based modulation transfer voltage regulator. Designed for long-life operation in the radiation environment near the nuclear reactor, the IPTT package regulates the DC output of a bank of nuclear reactor-heated, thermoelectric elements by reducing a constant load back into the element bank.



IPTT for radiation-resistant power conversion systems. For further information write to Power and Space Dept., for Data 250-450-250-450.



Industrial Products Division  
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ASW mission is a 500 x 500 sq. miles of ocean.

Because of the difficulty of conducting well-instrumented airborne ASW tests in the ocean and the problem of obtaining the use of live model nuclear submarines for extended periods of time, the new ASW simulator is expected to play a vital role in quantitative tests assessing new techniques. Choice of the contractor to build the simulator is expected to be announced soon.

The A-New program is an outgrowth of problems that have plagued new ASW aircraft in the past. One major problem is the lack of integration of the multiple sensors has been observed and the results of the output of a search radar program, according to Col. B. O. Stod, new representative Systems Division of NADIC's ASW Laboratory. Two frequently in this past, the overall effectiveness of the search and its airborne acoustic equipment did not satisfy. Unweighted tests under actual operating conditions still dozens of months have been produced and dozens more were in production, Stod said.

Two years ago, in an effort to correct this situation, Navy requested contract to four firms of various companies to study the feasibility of using a central

digital computer for ASW data processing. The team was headed by North American's Aerospace Division, Hughes Aircraft Co. Laboratories, Division of General Precision and Loral Electronics. Under the study, the companies were to consider not only existing ASW sensors but new sensors under development. The study reports indicated that the concept had much to offer in improving the effectiveness of airborne ASW operations.

Last December, after Navy approval for A-New had been granted, the present team of contractors was selected and the program was officially headed. Recognizing that system integration is both a state of affairs and a state of mind, Navy ASW project managers have great stress on bringing Navy and industry team members together at frequent intervals for mutual progress reports and to work out interface problems.

To facilitate industry with the objectives of the A-New program and Navy's anticipated future requirements for airborne ASW missions, NADIC gave a classified briefing over Wednesday morning to industry. Program personnel also are available on Wednesday to answer questions on the project.

## FILTER CENTER

► Laser-Gate Security Gates—Angular rates as low as 4 deg. per minute have been detected by Space Groupings Company, a simplified version of the laser gate. This is a low-level representation on the figure achieved earlier this year (AW Feb. 11, p. 50). Improved model was only a single gun laser tube, operating at 1.5 mW, with a 100-mW laser tube, with an even improved to deflect the beam into a square optical path. Company says it has achieved rates of 1 deg./min using a tungsten cathode, with gun laser tube, with 1.5 mW, and 0.012 mW. Space has just received a \$100,000 contract from Air Force's Nondestructive Systems Division to continue to work on increasing sensitivity and trying different optical path configurations and wavelengths.

► Delicate Space Cores—Electronic industry's share of the defense budget is expected to total \$8.5 billion in fiscal 1964, roughly 10% of the total cost, with an estimated \$7.7 billion in current test, according to Electronic Industries Association's production. Estimated share of the DOD research, development, test and evaluation category for the coming year is \$2.1 billion, or 20% of the total, compared with \$1.2 billion, or 26%, for fiscal 1963. EIA estimates that roughly one-fourth of NASA's fiscal 1964 budget of \$1.6

billion will go for electronics, with an additional \$168 million coming from Federal Aviation Agency. Total government figure will be about \$10 billion.

► Microcircuit Interest Grows—As though airborne and spaceborne applications give microcircuit technology its initial impetus, there is growing interest in its use for large surface and chip-based electronic components. Improved reliability is a major objective for surface applications but the lower weight, power consumption and smaller size are not unimportant considerations. Navy's Bureau of Ships now will specify its first positional microcircuit test built by Bellman Electric using thin-film techniques.

► High Thin-Film Capacitors—Thin-film capacitor dielectric materials form a kind of circuit materials which are required components which are used in the 10 microhenry range has been developed by North American's Aerospace Division as part of its extensive microcircuit activity (AW May 14, p. 52). The thin dielectric is formed by depositing silicon monoxide, then both silicon monoxide and the silicon each component and finally silicon

monoxide again. Work is being up to 400 volts has been achieved at low values of capacitance. Although these voltages are well above levels of interest in microcircuitry.

► Signed on the Dotted Line—Navy contracts that have been let, based awarded to various companies include the following:

► Electro-Mechanical Research, Inc., Simsbury, Conn., will develop and build ruggedized ultrasonic calibration in acoustic medium spectra at 2,400 to 2,800 Angstrom wavelengths from ECM model location under a contract from Air Force's Air Force Research Center, Dayton, Ohio. The contract is intended to obtain acoustic measurements for use in the Mach early warning system program (AW Dec. 24, p. 19).

► National Cash Register Co., Dayton, will develop techniques for improving efficiency of sodium-vapor solid state cells made by thin film deposition process. The company was awarded a \$175,499 contract from Air Force's Astronautical Sciences Division for the work.

► Laboratory for Electronics, Boston, will build 15 lightweight, portable AM/TM 12 GCA radar sets under a \$1.6 million contract received from Royal Swedish Air Force. Company earlier had sold five TM-12 sets for use by Royal Swedish Air Force.

## NEW AVIONIC PRODUCTS

► Thermocompensation bonding machine, high-speed method type designed to handle gold wire in diameter of 1 to 10 mil, zero temperature control.



capacitor which fits into heated leads. Devices are performed in a suspension bath with oil. Bonding time and pressure are adjustable over wide range. Manufacturers two machine can make up to 750 bonds per hour. Manufacturer: Tech Tech Manufacturing Co., 12654 Bushwood Dr., Sunnyvale, Calif.

► Eight-channel recorder, direct-writing type, provides a 50 in. continuous dia-



play of analog data for quick analysis. Device, developed to record broadband data from manned space flights, provides direct view of up to 75 msec of post data. Fabrication controls enable operator to adjust attenuation, gain and pen position. Manufacturer: Minuteman Systems, a 70 in. chart display. Manufacturer: Bank Instrument Division of Clevite Corp., 1715 E. Perkins, Cleveland 14, Ohio.

► Sensitive digital voltmeter, Model DMV-171, using all solid-state components, can generate ratio signals between 1:4 and 15:1 in accuracy as small as 100 counts up to 7 sec and 100 counts from 7.5 sec. Amplitude can be stored independently of other.

► Low-noise parametric amplifier, for 400 mc operation, has noise figure quoted at 10 db including circulator but excluding second-stage noise. Gain is quoted at 15 db and bandwidth at 8 mc, with gain stability better than

10 db for 24 hours. Full-scale operation is provided by two independent stages of amplification in which failure of either automatically bypasses faulty stage. Added technical information is available from manufacturer: Micron Systems Corporation, 6134 Del Rey Ave., Van Nuys, Calif.



► Static thermal switch, thermocouple with positive thermal of most negative has positive coefficient, experiences abrupt increase in resistance as predetermined temperature is reached. Non-positive temperature coefficient (PTC) thermocouple expansion negligible change of resistance at zero, increasing to 100% degree increase at function heat temperature. Units are available with increasing temperatures of 10, 55, 115, 115 and 115°C. Manufacturer: Westinghouse Electric Corp., Special Products Dept., Southfield, Mich., Youngwood, Pa.

broadband, weights 1.4 oz. and occupies 1 cu. in., with the weight and 17000 the rate of conversion. Improved microcircuit amplifier with comparable performance. Noise figure is quoted at 1.5 db nominal with overall gain of 15 db for 10-sec amplification. Operating temperature range is -55C



to 100C and input power amplified is 6 mW at 15 V. The amplifier also is available in models having center frequency at 30 mc and 60 mc, requiring 12.15 db gain per stage. Manufacturer of the model: Loral Electronics Corporation, 525 Blake River Ave., Buena Vista, N.Y.

► Digital frequency synthesizer, Model DMV-171, using all solid-state components, can generate ratio signals between 1:4 and 15:1 in accuracy as small as 100 counts up to 7 sec and 100 counts from 7.5 sec. Amplitude can be stored independently of other.



Stability of output signal is quoted at one part in 100 million per year. Output is 100 mW across center range but can be increased to 250 mW, with some current change. Switcher design is novel in that there is no RF signal applied to any moving part in device. Manufacturer: Electronic Industries Corp., 1701 S. Hill St., Los Angeles 7, Calif.

► Static thermal switch, thermocouple with positive thermal of most negative has positive coefficient, experiences abrupt increase in resistance as predetermined temperature is reached. Non-positive temperature coefficient (PTC) thermocouple expansion negligible change of resistance at zero, increasing to 100% degree increase at function heat temperature. Units are available with increasing temperatures of 10, 55, 115, 115 and 115°C. Manufacturer: Westinghouse Electric Corp., Special Products Dept., Southfield, Mich., Youngwood, Pa.

## New Department of Defense Standard Rocket, Missile, Probe Designations

### Missile Prefix Symbols Detailed

Following missile symbols are used in the new Defense Dept. missile designation system (AW 104-1, p. 311):

| Term                          | Title                   | Description   |
|-------------------------------|-------------------------|---|
| A                             | Special Task, Temporary | Vehicles are special task programs by selected applicants and vehicles are loaned out, not having a special configuration to accommodate this task. At completion of the task the vehicles will be returned to their original configuration or returned to standard operational configuration.        |
| H                             | Special Task, Permanent | Vehicles are special task programs without a profile and vehicles are loaned out, not having a special configuration. At completion of the task the vehicles are returned to their original configuration or returned to standard operational configuration. At least one permanent or extended task. |
| R                             | Experimental            | Vehicles are a development or experimental stage, but not subjected to standard vehicle test or stress test.  |
| T                             | Prototype               | Prototype vehicles generated for evaluation and test of a specific design.  |
| Z                             | Planning                | Vehicles in the planning or pre-development stage.  |
| <b>LABOR EQUIPMENT STATUS</b> |                         |   |
| A                             | Alt                     | Alt Machine   |
| B                             | Booby                   | Capable of being switched from normal into surveillance mode.   |
| C                             | Cable                   | Electrically wired in a portable manner and located from the ground.  |
| L                             | The Street              | Vertically stored below ground level and located from the ground.   |
| L                             | Side Located            | Vertically stored and located from level ground level.  |
| R                             | Radio                   | Located from a ground vehicle to maintain a location.   |
| P                             | Hold                    | Portably transported in storage and located from the ground.  |
| F                             | Self Prop               | Located from a surface vessel such as a tug, barge, etc.  |
| U                             | Underwater              | Located from a submarine or other underwater vehicle.   |

*Mitella repens*.

| Letter ID | Title/Strategy       | Description   |
|-----------|----------------------|---|
| A         | Deception            | Vehicles designed to be modified in position, direction, or speed without detection by observation or attack vehicles   |
| B         | Camouflage/Disguise  | Vehicles designed to be modified with structures designed to be undetectable or to resemble innocuous, distinguishable civilian structures, or other structures involving no military mission |
| C         | Deception            | Vehicles designed to deliver weapons and/or munitions   |
| D         | Intercept/Attack     | Vehicles designed to intercept and/or destroy   |
| E         | Deception            | Vehicles designed for target reconnaissance, or surveillance, or observation  |
| F         | Training             | Vehicles designed to permanently modified for training purposes   |
| G         | Multi-mission/Attack | Vehicles designed to destroy enemy personnel and/or other military targets or to deliver ordnance   |
| H         | Warning              | Vehicles designed to observe, report or collect data pertaining to unauthorized phenomena   |

Manufacturer's Code Letter

[illegible]

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED

| Enamel Designation | Resin Composition | Popular Name   | Service |
|--------------------|-------------------|----------------|---------|
| Amalgam 1C         | Ten-10C           | Kometech       | AF      |
| Amalgam 1D         | Amalg 10D         | Technic 10-10C | USA     |
| Amalg 2B           | Amalg 2B          | Technic 10-10  | USA     |
| Amalg 3A           | Amalg 3A          | Tenacore 10-10 | USA     |
| Amalg 12B          | Amalg 12B         | Tenacore 10-10 | USA     |
| Amalg 12C          | Amalg 12C         | Tenacore 10-10 | USA     |
| Amalg 14A          | Amalg 14A         | Technic 10-10  | USA     |
| Amalg 14B          | Amalg 14B         | Technic 10-10  | USA     |
| Amalg 14C          | Amalg 14C         | Technic 10-10  | AF      |
| Amalg 14D          | Amalg 14D         | Technic 10-10  | AF      |
| Amalg 14E          | Amalg 14E         | Technic 10-10  | AF      |
| Amalg 14F          | Amalg 14F         | Technic 10-10  | AF      |
| Amalg 14G          | Amalg 14G         | Technic 10-10  | AF      |
| Amalg 14H          | Amalg 14H         | Technic 10-10  | AF      |
| Amalg 14I          | Amalg 14I         | Technic 10-10  | AF      |
| Amalg 14J          | Amalg 14J         | Technic 10-10  | AF      |
| Amalg 14K          | Amalg 14K         | Technic 10-10  | AF      |
| Amalg 14L          | Amalg 14L         | Technic 10-10  | AF      |
| Amalg 14M          | Amalg 14M         | Technic 10-10  | AF      |
| Amalg 14N          | Amalg 14N         | Technic 10-10  | AF      |
| Amalg 14O          | Amalg 14O         | Technic 10-10  | AF      |
| Amalg 14P          | Amalg 14P         | Technic 10-10  | AF      |
| Amalg 14Q          | Amalg 14Q         | Technic 10-10  | AF      |
| Amalg 14R          | Amalg 14R         | Technic 10-10  | AF      |
| Amalg 14S          | Amalg 14S         | Technic 10-10  | AF      |
| Amalg 14T          | Amalg 14T         | Technic 10-10  | AF      |
| Amalg 14U          | Amalg 14U         | Technic 10-10  | AF      |
| Amalg 14V          | Amalg 14V         | Technic 10-10  | AF      |
| Amalg 14W          | Amalg 14W         | Technic 10-10  | AF      |
| Amalg 14X          | Amalg 14X         | Technic 10-10  | AF      |
| Amalg 14Y          | Amalg 14Y         | Technic 10-10  | AF      |
| Amalg 14Z          | Amalg 14Z         | Technic 10-10  | AF      |
| Amalg 14AA         | Amalg 14AA        | Technic 10-10  | AF      |
| Amalg 14AB         | Amalg 14AB        | Technic 10-10  | AF      |
| Amalg 14AC         | Amalg 14AC        | Technic 10-10  | AF      |
| Amalg 14AD         | Amalg 14AD        | Technic 10-10  | AF      |
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| Amalg 14AG         | Amalg 14AG        | Technic 10-10  | AF      |
| Amalg 14AH         | Amalg 14AH        | Technic 10-10  | AF      |
| Amalg 14AI         | Amalg 14AI        | Technic 10-10  | AF      |
| Amalg 14AJ         | Amalg 14AJ        | Technic 10-10  | AF      |
| Amalg 14AK         | Amalg 14AK        | Technic 10-10  | AF      |
| Amalg 14AL         | Amalg 14AL        | Technic 10-10  | AF      |
| Amalg 14AM         | Amalg 14AM        | Technic 10-10  | AF      |
| Amalg 14AN         | Amalg 14AN        | Technic 10-10  | AF      |
| Amalg 14AO         | Amalg 14AO        | Technic 10-10  | AF      |
| Amalg 14AP         | Amalg 14AP        | Technic 10-10  | AF      |
| Amalg 14AQ         | Amalg 14AQ        | Technic 10-10  | AF      |
| Amalg 14AR         | Amalg 14AR        | Technic 10-10  | AF      |
| Amalg 14AS         | Amalg 14AS        | Technic 10-10  | AF      |
| Amalg 14AT         | Amalg 14AT        | Technic 10-10  | AF      |
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| Amalg 14BL         | Amalg 14BL        | Technic 10-10  | AF      |
| Amalg 14BM         | Amalg 14BM        | Technic 10-10  | AF      |
| Amalg 14BN         | Amalg 14BN        | Technic 10-10  | AF      |
| Amalg 14BO         | Amalg 14BO        | Technic 10-10  | AF      |
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| Amalg 14BQ         | Amalg 14BQ        | Technic 10-10  | AF      |
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| Amalg 14BS         | Amalg 14BS        | Technic 10-10  | AF      |
| Amalg 14BT         | Amalg 14BT        | Technic 10-10  | AF      |
| Amalg 14BU         | Amalg 14BU        | Technic 10-10  | AF      |
| Amalg 14BV         | Amalg 14BV        | Technic 10-10  | AF      |
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| Amalg 14BX         | Amalg 14BX        | Technic 10-10  | AF      |
| Amalg 14BY         | Amalg 14BY        | Technic 10-10  | AF      |
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| Amalg 14CA         | Amalg 14CA        | Technic 10-10  | AF      |
| Amalg 14CB         | Amalg 14CB        | Technic 10-10  | AF      |
| Amalg 14CC         | Amalg 14CC        | Technic 10-10  | AF      |
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| Amalg 14HJ         | Amalg 14HJ        | Technic 10-10  | AF      |
| Amalg 14HK         | Amalg 14HK        | Technic 10-10  | AF      |
| Amalg 14HL         | Amalg 14HL        | Technic 10-10  | AF      |
| Amalg 14HM         | Amalg 14HM        | Technic 10-10  | AF      |
| Amalg 14HN         | Amalg 14HN        | Technic 10-10  | AF      |
| Amalg 14HO         | Amalg 14HO        | Technic 10-10  | AF      |
| Amalg 14HP         | Amalg 14HP        | Technic 10-10  | AF      |
| Amalg 14HQ         | Amalg 14HQ        | Technic 10-10  | AF      |
| Amalg 14HR         | Amalg 14HR        | Technic 10-10  | AF      |
| Amalg 14HS         | Amalg 14HS        | Technic 10-10  | AF      |
| Amalg 14HT         | Amalg 14HT        | Technic 10-10  | AF      |
| Amalg 14HU         | Amalg 14HU        | Technic 10-10  | AF      |
| Amalg 14HV         | Amalg 14HV        | Technic 10-10  | AF      |
| Amalg 14HW         | Amalg 14HW        | Technic 10-10  | AF      |
| Amalg 14HX         | Amalg 14HX        | Technic 10-10  | AF      |
| Amalg 14HY         | Amalg 14HY        | Technic 10-10  | AF      |
| Amalg 14HZ         | Amalg 14HZ        | Technic 10-10  | AF      |
| Amalg 14IA         | Amalg 14IA        | Technic 10-10  | AF      |
| Amalg 14IB         | Amalg 14IB        | Technic 10-10  | AF      |
| Amalg 14IC         | Amalg 14IC        | Technic 10-10  | AF      |
| Amalg 14ID         | Amalg 14ID        | Technic 10-10  | AF      |
| Amalg 14IE         | Amalg 14IE        | Technic 10-10  | AF      |
| Amalg 14IF         | Amalg 14IF        | Technic 10-10  | AF      |
| Amalg 14IG         | Amalg 14IG        | Technic 10-10  | AF      |
| Amalg 14IH         | Amalg 14IH        | Technic 10-10  | AF      |
| Amalg 14II         | Amalg 14II        | Technic 10-10  | AF      |
| Amalg 14IJ         | Amalg 14IJ        | Technic 10-10  | AF      |
| Amalg 14IK         | Amalg 14IK        | Technic 10-10  | AF      |
| Amalg 14IL         | Amalg 14IL        | Technic 10-10  | AF      |
| Amalg 14IM         | Amalg 14IM        | Technic 10-10  | AF      |
| Amalg 14IN         | Amalg 14IN        | Technic 10-10  | AF      |
| Amalg 14IO         | Amalg 14IO        | Technic 10-10  | AF      |
| Amalg 14IP         | Amalg 14IP        | Technic 10-10  | AF      |
| Amalg 14IQ         | Amalg 14IQ        | Technic 10-10  | AF      |
| Amalg 14IR         | Amalg 14IR        | Technic 10-10  | AF      |
| Amalg 14IS         | Amalg 14IS        | Technic 10-10  | AF      |
| Amalg 14IT         | Amalg 14IT        | Technic 10-10  | AF      |
| Amalg 14IU         | Amalg 14IU        | Technic 10-10  | AF      |
| Amalg 14IV         | Amalg 14IV        | Technic 10-10  | AF      |
| Amalg 14IW         | Amalg 14IW        | Technic 10-10  | AF      |
| Amalg 14IX         | Amalg 14IX        | Technic 10-10  | AF      |
| Amalg 14IY         | Amalg 14IY        | Technic 10-10  | AF      |
| Amalg 14IZ         | Amalg 14IZ        | Technic 10-10  | AF      |
| Amalg 14JA         | Amalg 14JA        | Technic 10-10  | AF      |
| Amalg 14JB         | Amalg 14JB        | Technic 10-10  | AF      |
| Amalg 14JC         | Amalg 14JC        | Technic 10-10  | AF      |
| Amalg 14JD         | Amalg 14JD        | Technic 10-10  | AF      |
| Amalg 14JE         | Amalg 14JE        | Technic 10-10  | AF      |
| Amalg 14JF         | Amalg 14JF        | Technic 10-10  | AF      |
| Amalg 14JG         | Amalg 14JG        | Technic 10-10  | AF      |
| Amalg 14JH         | Amalg 14JH        |                |         |

#### EXPERIMENT 1


| Current Designation | Reverse Designation | Product Name  | Source  |
|---------------------|---------------------|---------------|---------|
| AGS R 1A            | M-20                | Remont-John   | USA     |
| AGS R 1B            | M-20                | Remont-John   | USA     |
| AGS R 1C            | M-20                | Remont-John   | USA (L) |
| AGS 1B              | M-14                | Gracie        | USA     |
| AGS 1B              | M-14B-1             | Gracie Gracie | AF      |
| AGS 1A              | M-50                | Likins Inc.   | USA     |
| GR 4A               | -----               | Whisper Alpha | USA     |
| GR 3A               | -----               | ASDC          | USA     |

## REVISED CURRIC.

| Control<br>Study/series | Fixed<br>Designs | Popular<br>Name | Score |
|-------------------------|------------------|-----------------|-------|
| Plot 1-1A               | XXXX-01          | .....           | AF    |
| Plot 1-2A               | XXXX-04          | .....           | AF    |
| Plot 1-3A               | XXXX-03          | .....           | AF    |
| Plot 1-4A               | XXXX-06          | .....           | AF    |
| Plot 1-5A               | XXXX-00          | .....           | AF    |



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HUGHES TOOL COMPANY, Aircraft Division, Culver City, California 

## Atlantic's Performance, Avionic Gear Displayed



Both being prototypes of the Republic Y11H Atlantic ASM aircraft were flown at the First Air Show, demonstrating landing and takeoff, and the operation of various gear including the retractable belly tankage under the cockpit. The aircraft, both under a cooperative North Atlantic Treaty Organization program financed by the nations (AW June 18, p. 12), is powered by two Rolls Royce Type 20 turbo-prop engines rated at 6,000 each. Both have supplied engines for the prototype, but later production engines are due to be supplied by France's Eclairage Suez. The third prototype (shown) has a clear plastic nose section. Nose on the first prototype (left) resembles a radome, but actually is a third plastic bomb-bomb-type window. Both are fitted with MAM detection gear in the tail shroud, and the firing on top of the fuselage houses avionic gear. Both aircraft are shown at Ft. Rucker Airport (below). Second prototype was lost in a crash last April.







JULY 22, 1963

## MANNED SPACE FLIGHT ISSUE

• The most important development of this decade, MANNED SPACE FLIGHT, will be the subject of the July 22, 1963 issue of AVIATION WEEK & SPACE TECHNOLOGY. MANNED SPACE FLIGHT, the major segment of the national space program, is planned at \$20 billion for a manned lunar landing. The total space budget requested for fiscal 1964 alone is a record \$7.3 billion.

AVIATION WEEK & SPACE TECHNOLOGY has established an unmatched reputation for detailed coverage of technical and industry developments on the plans, operations, facilities, budgets, organization and procurement policies of the national space program. Now, a task force of editors will concentrate on both civilian and military manned space projects in an issue devoted entirely to the subject.

Themes of the issue will stress future programs from Project Apollo to manned permanent moon bases, manned orbiting space stations and interplanetary Mars and Venus flights. Editorial highlights will include:

- Major progress report on Project Apollo, its hardware and technical developments
- Status Report on Project Gemini two-man spacecraft including joint NASA-USAF operations
- What we learned from Project Mercury and how it built a technical foundation for future manned space flight programs
- Technical needs of military in manned space flight, including Dyna-Soar, Aerospace Plane, maneuverable re-entry vehicles, inspector and surveillance satellites
- Russian manned space flight programs and technical progress
- New types of support operations required for large-scale manned flight including satellites, control centers, transport and assembly facilities, tracking and data transmission equipment, medical and life support

There is no better way to identify your company's role in the space program than by scheduling your advertising in the most important issue of 1963, the July 22nd MANNED SPACE FLIGHT ISSUE. Its timeliness and scope of technical detail will insure industry-wide attention and study. Write or call collect for reservations or additional information.

**Aviation Week  
& Space Technology**

4 PUBLISHED WEEKLY, PUBLICATIONS DIVISION, 1200 N. 17TH STREET, AUSTIN, TEXAS 78761

[illegible]

## TELESCOPIC BOOMED CRANES\*



GAILLAND

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Washington—Army spent ten years in developing an air transportable truck—the M151—but failed to include the key device for air mobility in letting a production contract to Ford Motor Co., according to a report to Congress by the General Accounting Office.

CAD and the scaffold is unnecessary modification costs that amounted to \$400,000.

The device consisted of a threaded lifting eye mounted at the center of each wheel hub to facilitate an delivery of the truck by pneumatic and external support by helicopter.

It was omitted from the original production contract for 4,850 M150 tanks let to Ford in June 1999. GAO

It was also omitted from a follow-up survey for 17,124 trucks let in 1961, according to GAO.

This occurred, the agency said, despite three facts:

\* During the 30-year period that the M151 vehicle has been under development, the principal military characteristics established with respect to transportability was that it could be air-dropped by parachute and externally transported by helicopter.

\* "The Army had a similar experience with another vehicle about a year prior to the onset of the initial M751 production control."

GAO said that in February, 1999, four months before the original product line contract, Ford had recommended the wheel-offside design.

Board of directors of Glaxo Corp. has elected H. A. Belinfante as chairman of the board and chief executive officer. Harry H. Witsell is president, and Walter R. Korman is executive vice president, following the death of J. C. Gosslett founder, chairman and president of the company, late last month (ENR July 1, p. 36).

Refuade, former vice chairman of the board, joined Garrett Corp. as assistant to the president in 1945. Prior to joining the company, he spent 13 years as an airline pilot for Transcontinental and Western.

Witzel, former executive vice president, joined Garrett's Allisonville Manufacturing Div. in 1946 as an engineer. He became assistant to the president in 1954, director in 1973 and executive vice president in 1982.

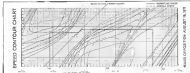
Remover joined Grant in 1970 and helped form the Adhesives Manufacturing Div. He has served as director and corporate vice president in charge of engineering since 1982.



North Dakota Travel has taken over the extended-term route (right) which moves all equipment forward and back to the job site in more compartments (440 in 89 vs. 31, less 12 vs. 18). Rear bogies now have been redesigned from 270-lb. capacity to 400 lb. Bowls hold injection nozzles elsewhere need to hold nozzles but, lowering fuel pressure to engine. Fuel capacity has been increased from 75 to 80 gal. Optional tanks will increase this to 112 gal. Goodhue 700 x 6 ring disk breakers have been added also, as are many modified 25-way, ground-side. Chisel rollers have been moved forward 1 in. to increase life span.



Radio proved to be the Travel Air redesign: he has control toward the pilot's seat (above left) and a dual fuel flow gauge has replaced the fuel pressure gauge. Front seats (above right) have been moved slightly closer by narrowing between seat bases.



At Lockheed Missiles & Space Company, a dedicated team of scientists devotes its entire attention to problems in interplanetary navigation. Of particular interest are problems attendant to the guidance of a manned vehicle to another planet. With many successful accomplishments to their credit (such as the Palanis and various Agena missions), the group faces every new challenge with confidence.

A pioneering mission for manned spacecraft guidance involves taking selected and planetary optical sightings, feeding that information into an onboard computer, and computing the spacecraft's position and velocity to predict its future course. The computer will then calculate the predicted destination planet error, decide if a correction is necessary, and

compete its rates. These procedures would be repeated continually until the planet is reached. The optimum timing and magnitude of corrections, in view of the information obtained from the observations, is the subject of continuing study.

Even before work on hardware for an interplanetary mission is begun, orbit characteristics must be determined to set the requirements to be built into the spacecraft. An optimum trajectory must be shaped for the specific mission, in order to realize ultimate effectiveness. An outstanding accomplishment by Lockheed scientists is the computation of some 250,000 different orbits to Mars and a similar number to Venus. Each orbit varies as to speed, fuel, departure, arrival, and elapsed time.

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## LOOK AT LOCKHEED IN FLIGHT MECHANICS:

Further advances in space flight leadership



## SPACE TECHNOLOGY

### Post-Apollo Passenger, Cargo Types Seen

Los Angeles—Current trends in National Aeronautics and Space Administration concepts for post-Apollo space vehicles point to two distinct types of configurations—one for transporting passengers, not yet given a program name, and Nova, the more widely publicized study for a freight-carrying vehicle.

Dr. Herman Koelle, director of future projects, Marshall Space Flight Center, said that the need for work (space) program vehicles is forecast for the mid-1970s. Present indications are that large orders by NASA for development of the vehicles will be made in 1967, based on the assumption that NASA's 10th class of the nation's first national product will occur at that time.

"We shall have to wait until the Apollo program is over the hazy before we have the money to go ahead with this program," Koelle said. He estimated that development of the smaller passenger-carrying vehicles will cost \$2.5 billion and take from six to seven years from goal to production of the first operational model. The earthlings' Mission-type vehicle probably would require at least seven years and \$7 billion for development.

A preliminary target date for delivery of the two types of vehicles is 1975, he said. These two projects represent the major launch vehicle program likely to be undertaken by NASA in the next decade, he added.

Present design studies indicate that the takeoff weight of the passenger vehicle would be around 1 million lb., while the Nova type would weigh approximately 20 million lb.

One consideration for definite planning on two distinct vehicles is the desire to distribute future space work among more companies, the NASA official said.

At present NASA is spending about \$5 million annually on Nova studies. About \$1.5 million per year now is going toward investigation of the passenger concept. NASA is contributing \$1 million, and the Air Force the remainder.

Koelle expects spending on these programs to increase slowly in the next few years.

Present thinking is that the passenger vehicle definitely will be a two-stage configuration because of weight considerations, while the Nova vehicle "could be a single stage," Koelle said. He anticipates that the general outline of design direction to be taken on Nova's configuration should be agreed at within six months, while preliminary decisions on the passenger vehicle will take as much as a year longer than that.

Reusability will be an important consideration in determination of the vehicle's design. Adoption of a reusable concept, Koelle said, will depend on the following three primary considerations:

- Development of a feasible recovery scheme for the vehicle, including a comparison of a sufficient low-risk factor.
  - An economic justification to government officials and Congress for the rate development and construction to prove that would be necessary to build a recoverable model.
  - Demand for a sufficient number of flights to enable reduction of the economic first successfully flown.
- Looking beyond the next decade, Koelle forecasts that after the U.S. might have an orbit-to-orbit transport system working, making use of recoverable, passenger and freight vehicles. The three-stage system would involve a classically propelled earth surface-to-earth orbit vehicle, a water-powered earth orbit-to-earth orbit rocket ferry, and another classically powered launch orbit-to-earth surface transport. The estimates that such a system could be due to \$3 million the cost of transporting one man to the moon and back, compared with the \$10 million per round trip with the Apollo.

Concerning modes of recovery, Koelle is leaning toward fuel weight and retro-rockets for passenger vehicles, and boosting rockets and parachutes for Nova-type craft. He estimates that a 5,000-weight payload would have to be paid for heavier construction demanded by a vehicle designed for reusability.



### French Topaze Booster Uses Swivelling Nozzles

Topaze solid-propellant second-stage for France's Diamant vehicle booster (AW June 17, p. 26) has been developed by SEP to fit a booster established by SNECMA, the French industrial consortium. The booster will have swivelling nozzles which will be employed for both direction and control. The second stage will remain essentially the same for the planned second generation Diamant, which will have a substantially greater overall thrust rating. Present test stage, using a liquid fuel motor, will be replaced by a solid-propellant unit. Solid-propellant third stage also will be redeveloped.





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—85F to 4700F. That is a permanent magnet voltage generator which uses a ceramic base moving inside a cylinder wound with a coil as its rotating mechanism. Temperature range is 6 in. Consolidated Electrodynamic Corp., 199 Stern Meadow Vld., Pasadena, Calif.

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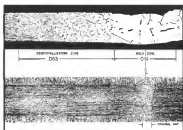
#### Oxygenic Thermometer

Oxygenic thermometer thermometers with 1 x 3 in. sensing probe measure temperature from -76.9°K.  $\pm 0.01^\circ\text{K}$  with  $\pm 0.01\text{K}$  water sensitivity.



Probe is inserted in material to be measured and output is adjusted to zero by a potentiometer.

Constructions are also directly in digital form on the potentiometer. Inc. Thermometer coil size is 5 x 3 x 1/2 in. Name: Instrument and Control Corporation, Apollo, Pa.



**MICROPHOTOGRAPH SHOWS DIFFERENCE** between electron beam welded tungsten joint (top) and Martin-Olshausen flame-sprayed reduction joint (bottom). Note asymmetry in top weld where tungsten was melted and solidified after cooling. Flame-sprayed weld cracks free.

## Refractory Metal Weld Developed

**OLSHAUS, Fla.**—Bonding technique developed by Martin-Olshausen for refractory metals such as tungsten and tantalum holds promise for easier joining of these materials and possibly their greater use in aerospace structures.

Refractory metals have certain properties which make their use in space structures desirable—their strength-to-weight ratios are good, even under elevated temperatures; their wear resistance is high and they generally are oxidation resistant. However, the advantage of strength is a disadvantage during the manufacturing process. Refractory metals do not readily bond themselves to forming and it is difficult to weld pieces without weakening the base metal.

#### Four Criteria

Martin-Olshausen's Mutual Lubrication Dept., under Saul R. Locke, has done more extensive work on a metal vapor-type of bonding, called flame-sprayed reduction, which is said to fit the four criteria of an "ideal" joint.

- Base material can be controlled by the process, which operates at temperatures well below its melting point.
- Bond of the filler material is metal-bonded, instead there is no sharp interface between base metal and filler.
- Strength tends to be uniform in the joint area.
- Filler material possesses the same properties as the base metal.

Basically, flame-sprayed reduction involves the vapor-deposit of a filler material identical to the type of metal to be joined. Upon cooling, the bond

formed is strong, not mechanical.

Working stock used by Martin-Olshausen in experiments was 6 x 16 in. rods made of 92 in. flux tungsten, from which 5 x 5 in. sample specimens were cut by hot-chambering. Surfaces to be welded, preparation to butt and lap welds, were ground and polished.

Specimens were mounted on a solid metal frame, tungsten filler metal block and polished by sandblasting through an electric arc applied to the opposite end of the block from the mounting. The heat temperature was about 1,200F., well below tungsten's normal melting point of 6,180F.

Filler material was a mixture of tungsten hexafluoride and hydrogen in a ratio of 1 to 5. Gas was applied to the heated specimens through a double nozzle—nozzle being a torching—so the flow directed at an angle across the joint of the specimens.

#### Cooling Period

In a heated environment, the tungsten hexafluoride and hydrogen gases lead to form hydrogen fluoride. Plus tungsten was deposited on the steel-liner atmosphere was maintained by open in the reduction chamber during the approximately 5-min. process. Cooling period lasted about 30 min.

Advantages of the process, Locke says, are that the grain structure of the deposited tungsten filler is almost identical with that of the specimens and that the specimens experience no degradation, though localized heating, is the area of the joint.



## ELECTRICAL ENGINEERS PHYSICISTS MATHEMATICIANS

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All qualified applicants will receive consideration for employment without regard to race, color, sex, or national origin.

**COLUMBUS DIVISION  
NORTH AMERICAN AVIONICS**





weight of N 1006F at the time of the accident is not known, it was computed to be 11,773 lb.

N 1006F was southwest bound on Victor Arroyo 41 (NE-BW). This area intersects with Victor Arroyo 30 (E-W) just to the southeast side. Because of the proximity of the accident site to the intersection of these areas, and certain weather state records, the possibility of a collision must also be considered in a pilot's decision to alter course, and certain weather state records, the possibility of a collision must also be considered in a pilot's decision to alter course, and certain weather state records, the possibility of a collision must also be considered in a pilot's decision to alter course.

#### Analysis and Conclusions

It is determined from the investigation that the accident was caused when the aircraft was properly maintained, that the aircraft was properly maintained that there was no flight data that there was no evidence of no flight data with a flight report, that the weather was not a factor, and that the presence of conflicting air traffic is not supported by available evidence.

The engine failure of the right wing panel and the fuel nozzles from that engine as well as the investigation. The engine failure of the right wing panel and the fuel nozzles from that engine as well as the investigation. The engine failure of the right wing panel and the fuel nozzles from that engine as well as the investigation.



#### New Soviet Turbine Helicopter Shown

Russia's twin-engine powered helicopter, the Mi-2, shown above in low flight, is a development of the Mi-6. It carries up to eight passengers and crew, can cruise at 150 mph. Dimensions are similar to the Mi-6, length about 70 ft, and rotor diameter about 40 ft. Soviet recently showed a speed record of 160 mph (260 km per hr) over a 42.34 mi. (100 km) course with the Mi-2.

in full altitude conditions setting of 25 deg. Refueling control system loss in flight, a pilot would be required to insert a fuse of approximately 150 lb. to override the first second of uncontrolled motion from when the aircraft was in a free-fall state of 175 ft. At the end of two seconds the second fuse would approximately double.

If, prior to the subject accident, the fuel system was applied to N 1006F as a standard procedure, other automatically and inadvertently and at the time a reserve fuel condition developed, the pilot's reaction would probably have been to avoid the fuel burnout of the aircraft with the fuel tank. The fuel tank would have been to avoid the fuel burnout of the aircraft with the fuel tank. The fuel tank would have been to avoid the fuel burnout of the aircraft with the fuel tank.

The N 1006F, the time from uncontrolled motion to a landing, is approximately 15 sec. The time from uncontrolled motion to a landing, is approximately 15 sec. The time from uncontrolled motion to a landing, is approximately 15 sec.

The fuel nozzles from that engine as well as the investigation.

the electric elevator system, this unit which would be a result of a recommendation made by the Board to the Federal Aviation Agency, in order to eliminate the possibility of a similar accident, the electric elevator system, this unit which would be a result of a recommendation made by the Board to the Federal Aviation Agency, in order to eliminate the possibility of a similar accident.

#### Recommendations

As a result of a recommendation made by the Board to the Federal Aviation Agency, in order to eliminate the possibility of a similar accident, the electric elevator system, this unit which would be a result of a recommendation made by the Board to the Federal Aviation Agency, in order to eliminate the possibility of a similar accident.

By the Civil Aeronautics Board  
Albert Boyd, Chairman Robert F. May  
Phyllis C. Coleman, Chairman  
John G. Joseph, Member  
William G. Gilford, Member

#### Investigation

The Civil Aeronautics Board was notified of the accident at approximately 10:27 EDT, Sept. 5, 1962, and an investigation was conducted in accordance with the provisions of Title VII of the Federal Aviation Act of 1958 as amended.

#### Aircraft Owner

Lackland Lander N 1006F was owned by Lackland Oil & Refining Co., Ashland, Ky.

#### Air Crew

Arthur B. Robinson, age 49, was employed by Lackland Oil & Refining Co. on Jan. 16, 1948, as Chief Pilot and had been employed as such since approximately 1970. He held a private pilot certificate, 1970, and a commercial pilot certificate, 1970, and a commercial pilot certificate, 1970, and a commercial pilot certificate, 1970.

Robinson indicated that he was issued a first-class medical certificate on Feb. 1, 1962, which contained no remarks or limitations.

#### The Aircraft

Lackland Lander N 1006F Model 16, serial number 1601, was owned and operated by Lackland Oil & Refining Co., 1409 Winchester Ave., Ashland, Ky. Total time on the aircraft was 6157.44 hr. The first engine inspection was accomplished on Aug. 26, 1962, by the Republic Aircraft Co., Tulsa, Okla. The aircraft had accumulated 450.30 hr. in service by the time of the accident on the last day of the accident.

The aircraft was equipped with two Wright Model 1020 D1 engines and the main rotor was Hamilton Standard model 214M-475 with DMC 5210-11 Main

## WHO'S WHERE

(Continued from page 15)

### Honors and Elections

C. Thomas French, manager of general relations for P. R. Miller Co., has been elected president of the Institute of Navigation.

Dr. James H. Hines, president of RCA Laboratories, has been named as president of the Institute of Navigation. Dr. Robert L. Mader, chairman of the University of Rochester Department of Physics and Astronomy, has been named chairman of the National Academy of Sciences Advisory Committee for Eastern Europe.

### Changes

Wesley T. Wilson, Jr., assistant to the vice president, Arms Research Corp., Washington, D. C., a subsidiary of Aero-Naval Inc.

Dr. Robert H. Hines, chairman of the Institute of Navigation, has been named as president of the Institute of Navigation.

R. J. Smith, assistant to the vice president for technical development, Rocket Development, Inc., has been named as president of the Institute of Navigation.

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